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What About Automobile Shops?

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Competition in the automobile field will be intense in 1924—Capacity exceeds demand—Best equipped manufacturers have the advantage—How well prepared is the industry as a whole?

FOR YEARS the automobile industry has stood for the ultimate in American interchangeable manufacture. What is its condition today? Is equipment up-to-date and in good condition? Have production methods kept pace with advanced engineering design? Is there room for further improvement in machine tool designs and for new types of machines?

These are some of the questions we propose to answer in this article and the ones to follow it. If our suggestions and friendly criticism are of practical benefit to the industry we shall feel that the time and effort we have put in on them has been well spent.

SOME rather impressive figures on the risk involved in manufacturing automobiles for the American public were brought to our attention recently. Their compilers had made up a list of all the companies engaged in the business during each of the last five years and against these totals had set up the number of failures as reported by one of the big credit agencies. The percentage of failures was decidedly startling running up to more than 30 per cent in 1921 which, of course, was a bad year. The gravity of the situation was emphasized by comparing the per cent of automobile failures with the average per cent of failures of all American business. It sounds incredible but the result showed the automobile percentage to be over thirty times as much. To make matters worse the figures give the average amount of liabilities in the automobile failure as something over ten times as great as in the average business failure.

Here is something serious for the automobile builders to think about and also for those who sell various kinds of equipment to them. It is also a matter of concern for the ultimate consumer who is certainly not over anxious to be the proud possessor of an orphan car.

The failures mentioned naturally occur among the weaker producers and probably have but little effect on the total output of automobiles. Nevertheless they show what happens to the manufacturer who is not adequately equipped to meet the aggressive competition of today.

The saturation point in the automobile market has been a decidedly elusive factor ever since the automobile business really got on its feet. All sorts of dire predictions have been made as to the speedy calamity that was due to befall the industry about twelve months hence. But up to the present time the saturation point has proved to be a veritable will-o'-the-wisp, dancing on ahead every time the forecasters thought it had nearly been reached. For the sake of those who build automobiles and also of those who build the machines which make automobiles we hope that the saturation point is still far ahead. There are several things, however, which lead us to believe that we are at last getting closer to it. One of the most significant is the fact that cash sales of passenger cars are getting to be matters of congratulation among automobile salesmen. Elaborate machinery has been provided by the larger organizations to provide for the carrying of various partial payment plans, and most of them have been entirely successful. We do not mean to infer that it is poor business to sell automobiles on time as that is a custom that prevails in many branches of commerce. Nevertheless, we do believe that the change from straight cash to partial payments indicates that automobiles are getting harder and harder to sell even to the undiscriminating buyer.

The good old days, when anything that would run on four wheels could be sold to an eager purchaser, are gone forever. The desire for individual transportation is probably stronger than it ever was for the effect of the early missionary work of the automobile sales forces has grown like a snowball. Unfortunately, a large number of the would-be purchasers of new cars already possess something in the way of a motorized vehicle and the trade-in question looms large. In view of the small allowances it will be possible to make such would-be purchasers it seems certain that only a very excellent product in each price class will bring sales. To manufacture such a product will require first-class factory

equipment and management if any money is to be made.

Another thing which will certainly bring the saturation point closer is the increasing capacity of the automobile plants. Not a great deal of new construction is going on, but methods are constantly being improved and better equipment is steadily being provided so that more cars can be manufactured in the same building area and by the same operatives. Someone has estimated that the automobile plants, if run at capacity, can turn out in the neighborhood of 5,000,000 cars for the season of 1924. The same estimator appraises the market as capable of absorbing somewhere between 2½ and 3 million cars. What is to become of the others?

With such figures as these before us it seems obvious that competition in the automobile industry will be keener during the next year than it has ever been before. With more supply than demand it goes without saying that the company which can turn out the best car for the least money in any given price class will survive at the expense of its less efficient competitors. Consequently, the subject of efficient mass production is a decidedly live one for the manufacturers of motor cars.

The time honored question, as to whether or not the hen antedated the egg, is about as easy to answer as the question as to which has done the most for the other, the automobile or the machine tool. Certainly the modern automobile would not be possible without the machine tool and the machine tool would hardly have reached anywhere near its present development without the stimulus of the efficient methods of the automobile manufacturers. We believe that there can be little question that when the automobile started its meteoric career shortly after 1900, it found machine tools for its production that were pretty well stabilized in design. Things had been rather dull in the machine tool business and there had been no particular need for better tools than were being turned out at that time. Machinery comparable in size with the automobile was almost universally built rather than manufactured. Standard tools were entirely adequate for such requirements. When it became necessary to produce automobiles in large quantities to satisfy the rapidly increasing public demand for them there was an imme diate cry for better and higher production machine tools. The machine tool men were not slow to rise to their opportunity and many tools were developed during the early automobile days which practically marked a revolution in machine tool design.

Mass Assembly Far Advanced

The automobile plants of the United States have for years been held up as the last word in mass production and assembly. They have been given credit for leading the mechanical world in these two phases of manufacturing. With the idea of ascertaining just what the present conditions are in the automobile shops and how well justified this reputation is, the authors of this article and the ones to follow made a careful investigation of a number of representative plants. Both passenger car and truck plants were visited and practically the full range of price classification is included.

The results of our investigation were rather surprising to us. It is perhaps sufficient to say now that, so far as mass production of machined parts is concerned, most of the automobile shops have something to learn from the methods employed in other manufacturing industries. When it comes to mass assembly, however, they are in a class quite by themselves where units of such size are concerned. Generally speaking we found a large and efficient application of the conveyor to unit and final assembly. The same thing cannot be said for inter-machine conveyors. In one or two plants the installations showed the result of careful study and were working with considerable efficiency. In other shops the transfer methods were about what one would expect to find in a good job shop. In one of the largest plants visited where conveyors are used to a very considerable extent they were so arranged that the major part of the work done by some of the men consisted of lifting parts higher than their heads. In most cases it would have been perfectly simple to run the conveyors at a handier elevation, thus conserving a great deal of physical energy.

No Uniformity in Speeds and Feeds

As to uniformity of practice in the machining of similar parts in different plants, it may be said that there is none. Cutting speeds on essentially similar parts in one plant were three or four times what they were in another plant. Local conditions, of course, will have a modifying effect on a good many processes, but there seems to be no good reason why there should be such a wide variation in speeds and feeds.

As to manufacturing equipment, there was naturally a wide difference. In some shops the policy of spreading the equipment appropriation uniformly over all departments making small improvements here and there, had been followed. In others the money had been spent in one department so that the equipment in this particular department consisted of the finest and most up to the minute machines and tools. The other departments were hopelessly out of date. The machines were not only old in design but actually worn and battered from excessive use. We naturally expect to see such things in railroad shops where conditions are entirely different but we were surprised to find them even in a few of the automobile shops.

Another factor in which there was wide difference was in the condition of the shop itself. In one shop, where production was proceeding at a high rate and every man seemed to be on his toes, the condition of the floor was such as to be a positive menace to safety, covered with a heavy layer of oil, chips and dirt, with every now and then a slippery metal cover plate for some opening. It was a case of watch your step constantly or else slip and fall into a machine or in someone's way. By contrast, another plant which had beautiful buildings but little new machinery was so immaculately kept as to be almost speckless.

It appeared to us that some of the plants had been constructed with too little attention to proper lighting. Good artificial lighting is desirable but it will hardly compare with good north daylight as arranged for in some of the better shops.

To return for a moment to the condition of the tools used, it is not too much to say that our slogan, "It Pays to Replace," could be applied with considerable profit. In our opinion it would pay to replace from one-third to one-half the equipment now in use in the average shop as either obsolete or worn out or both. It should be understood that some shops are in much better condition than this estimate would imply. Others are rather worse.

In this connection let it be clear that we are not attempting to criticize adversely the policy of the plant

administrations, for they doubtless had excellent reasons for not spending the money necessary to make their equipment all it might be. In fact we were told quite frankly in one plant where money had been spent in one department only that it was the company policy to maintain cash reserves at a high level and appropriate only what was deemed absolutely necessary for new equipment. With business conditions as they are at present, the policy of maintaining adequate cash reserves is entirely sound and we would be the last to question it. Nevertheless, we have felt that it might serve some useful purpose to describe conditions as they exist so that the automobile plant executives can compare their own shops with what is general practice and plan accordingly.

We want to testify to the generally courteous treatment accorded to us throughout our trip, and to say that, judging from the open-minded viewpoint displayed by the mechanical men who accompanied us on our rounds, the automobile business need have little fear of the future. If there is a keener, more intelligent group of mechanical supervisors in any industry in the country, we hope to meet them in the near future. Most of them were entirely aware of the weak places in their production equipment, and where we were able to make an occasional suggestion from the point of view of the disinterested outsider, they listened with attention. With such men as these in its service it is little wonder that the automobile industry occupies its present place in American productive enterprise.

International Aspects of the Safety Problem

By Royal Meeker
Secretary of Department of Labor and Industry of Pennsylvania

AMERICANS are prone to boast of the bigness and superiority of things American. We take pride in the biggest production, and we are not afraid of comparisons as to quality of our output with that of any other country. We have developed our industrial information services far beyond any European country and we do not hesitate to say so. Our industrial information informed us that we were killing and maiming men in industry to an appalling extent. The safety movement and the National Safety Council are the result, and today we stand far in advance of any other country in the world in safety appliances, safety organizations, safety training, safety meetings and everything that has to do with the safeguarding of lives and limbs of workers. When the International Labor Office set up a Safety Section, it looked to the United States as just a matter of course following the latest and best practices along these lines.

We spend proportionately, immensely more time, effort and money, than any other country to prevent accidents and to care for the worker who gets injured despite all preventive measures. Is not this a record—an achievement of which we might well be proud? Might not a little boasting of this record be permissible? Perhaps so; but before pointing with pride to our record and indulging our propensity for boasting, let us consider just what we have accomplished with our safety campaign.

Our Unenviable Record

We lead the world by miles in accident prevention. We lead the world by leagues in accident occurrence, and the economic losses due to accidents. We kill and maim more men per thousand full-time workers and per thousand tons of product than any other country. Unless we regard safety work as an end in itself, our pride in doing big things in a big way will be tempered by humiliation when we compare our achievements in the conservation of human life with those of European countries.

We may console ourselves if we are of a cheerful disposition by figuring out how many more workers we would have killed and maimed in industry if we had not started the safety movement. However, the experience of European countries rises up to mock us. These countries, except Germany and Great Britain, with little or no safety instruction, have much better accident experience than we. The accident statistics of no two countries are strictly comparable—for that matter the accident statistics of no two states of the United States are strictly comparable.

Nevertheless, making all reasonable allowances for discrepancies due to the different methods used in gathering and compiling accident statistics and for the differences in the basic material, it seems probable that in 1920 coal mining in the United States killed about three and a quarter times as many workers per thousand full-time employees as coal mining in Great Britain. More disturbing than the appallingly greater fatality rate is the fact that the relative fatality rates, though fluctuating rather widely, show on the whole a decided increase.

An Example of Bad Statistics

When we make comparison on the basis of the tonnage output, the figures show a lower fatality rate in the United States than in the United Kingdom per thousand tons of coal mined. This is as would be expected because of the much greater use of machinery in mining in our country, and the generally much richer and more accessible coal measures. We must not hastily assume that a low accident rate per thousand tons of output is a favorable accident rate. Quite the reverse is generally the case, as it is in this example.

The low fatality rate per thousand tons is due to the fact that human lives are sacrificed to the God of Big Output. Men are not merely machines to be worked to their limit with the object of producing the largest possible output before the man-machine is worn out or smashed to atoms. To measure deaths and disabilities of workers on a tonnage basis is utterly erroneous and bad statistics. The only just and accurate basis of reference is the man-hours worked, during which time the workers were exposed to the hazard of industrial accidents.

It is greatly to be desired that the accident statistics of all countries should be much improved and standardized so as to make it possible to compare the accident rates by industries and occupations. The International Labor Office was created primarily for the purpose of improving the conditions of labor in all countries and of equalizing these conditions by bringing the labor standards in backward countries up nearer to the level in the more advanced countries.

From an address delivered at the Twelfth Annual Safety Congress, held at Buffalo in October.

In the field of industrial accidents no country of the world has such high accident frequency and severity rates as the United States. What has been shown regarding our higher accident rates in coal mining holds true in all other industries and in street accidents. In no line do we outdistance Europe more emphatically than in the killing and maiming of men in industry and on the public highways. It is a bit anomalous for the nations of Europe, through the International Labor Office, to appeal to America, the greatest industrial killer, to send over apostles of safety to teach them how to save lives and limbs in industry. America is however a land of paradoxes. We do lead the world both in accident prevention and in accident production. Perhaps we excel in the art and science of telling others how to prevent accidents because we have so many accidents to give us practical studies in prevention.

It is difficult to account for the higher accident experience in the United States. It is due partly to the emphasis placed on highest speed in production, partly to improper lay-out and construction of plants, partly to the heterogeneous mixture of nationalities and races in our industries, but most of all to a spirit of recklessness on the part of masters and men alike. This last is, of course, in considerable part a result of the demand for big production. We Americans are, however, by reason of our environment, chance takers, and the workers in our industries manifest the gambling spirit in their work and in their play.

Accident statistics and accident prevention are, however, only two parts of the whole Industrial Health Program of the International Labor Office. Studies on an international scale are being made by the office of industrial diseases and poisons, and the best methods of prevention as shown by the experience in different countries. In the latest reorganization of the International Labor Office, I am informed that the Safety Section and the Industrial Health Section have been combined.

I have always held that it is just as unhealthy for a blast furnace worker to fall one hundred feet from the top of a furnace and light on his head as it is for him to breathe carbon monoxide until his breath ceases. It makes no difference to the worker or his dependents if he loses his hand by means of an unguarded gear or loses the use of his hand by means of mercury poisoning.

Unemployment Hazard

I cannot leave the consideration of the international aspects of the safety problem without some brief mention of the most important and the most destructive of all industrial hazards. The hazard of unemployment is not even considered an industrial hazard at all, although it is more truly an industrial hazard than any accident causing a physical wound or injury.

Unemployment is the only true industrial hazard. It is also far and away the most prevalent and the most detrimental of all industrial hazards. In periods of industrial crisis and depression, unemployment numbers its victims by millions, whereas physical accidents affect only thousands. The demoralization of workers due to unemployment and, what is perhaps as bad, the fear of unemployment, can scarcely be exaggerated.

The International Labor Office has from the beginning of its existence recognized the transcendent importance of unemployment as an industrial hazard, and has devoted much time and expense to the study of the amount of unemployment, its incidence, the results, the causes and the suggested means of ameliorating or preventing it. The serious study of all the influences and forces related to the facts, the results, the causes and the proposed cures for unemployment, goes far beyond the field of labor and industry. It goes to the very foundation of the existing social, political and economic order in all countries.

I do not expect a very important real contribution to the understanding of the causes of and remedies for unemployment will come out of the first preliminary attempt to study the problem internationally. I do rejoice, however, that there exists in the world today the League of Nations and the International Labor Organization—official, public, international agencies charged with the duty and vested with authority to make upon an international scale this investigation into unemployment, as well as any other investigation having a bearing upon the forces which make for discontent, misunderstanding and war.

Clutches in Machine Tools

By Frank C. Hudson

From several sources have come complaints of clutches used in connection with machine tools or their countershafts. These complaints are of two kinds, criticisms of the clutches themselves and also of their location. The first are directed at the action of the clutches, either because of their failure to carry the load or the difficulty in disengaging them when necessary.

The experience of the automobile builder should be of incalculable value in all questions pertaining to clutches and his experience is available to all who desire to profit by it. Automobile clutches have been developed to the point where little is to be desired. They are subjected to constant use and abuse at the hands, or feet, of millions, many of whom are without the slightest idea of how or why they act. Automobile clutches receive almost no attention and yet rarely fail to function. And their life is remarkably long when the service and abuse is considered.

Disk clutches, either single or multiple and wet or dry, have all worked out well. The tendency of larger cars is to use the single-plate dry clutch, but there are several million Fords with clutches running in oil, which transmit a maximum of 22 hp. Larger cars transmit up to 100 hp. with a single disk clutch so that the machine tool buildier has plenty of designs from which to choose.

The location of the clutches is a different matter and here the main complaint is inaccessibility for adjustment or repair, particularly the former. It is quite possible that this would cease to be such a vital question if the clutches were as good as those used in automobiles. For clutches in motor cars are seldom adjusted, if we can judge from the experience of the average user and driver.

Location of clutches is, however, an important matter and get-at-ability should be one of the first considerations. This may require considerable redesigning at times but the results are worth the effort. Customers appreciate machines which can be easily adjusted when necessary. For ease of adjustment means a shorter time for a machine to be out of commission, and idle time is coming to be one of the phases of production to be carefully considered.

Spiral Bevel Gears Which Can Be Hobbed

By NIKOLA TRBOJEVICH
Mechanical Engineer, National Twist Drill & Tool Co., Detroit

A new theory of bevel gearing—How a tapered hob can be employed—Method of determining the action of the gearing—The machine for doing the work

MANY attempts were made in the last twenty or thirty years aiming at the solution of the interesting but difficult problem of bevel gear hobbing, but so far no one has produced a correct solution to the problem. The following is a description of a new process of this kind which was developed and patented by the National Twist Drill & Tool Co., of Detroit. It is believed that this development represents a full and correct solution of the problem of bevel gear hobbing.

It may be stated right at the beginning that the problem is mathematically rather difficult on account of the three dimensional displacements and rotations which generally must be considered in such computations. In that respect the problem seemed to be almost hopelessly complicated at the beginning, and it was not possible even to approach it mathematically until certain kinematical peculiarities and short cuts were discovered, which greatly simplified the mathematical formulation of the proposition.

Until now it was generally accepted that a pair of bevel gears are theoretically correct if they are capable of meshing in an "apex-to-apex" position, that is, with a rolling engagement similar to that of a pair of spur gears having parallel shafts. However, after a brief reflection a conclusion may be formed that the possibilities of bevel gearing should not be exhausted by any means, by that one kind of meshing alone. For, a conical system of gearing should not be inferior in any respect to a cylindrical or spur system. In fact, if anything, it ought to be superior, because in a conical system the cone angles of the individual gears may be selected at will to suit any particular requirements, while in spur gearing all gears must necessarily have the same or zero cone angle.

Thus, the correct bevel gears ought to do, at the least, the following four things: (1) Mesh among themselves with a screw engagement when their axes are non-intersecting and non-parallel; (2) mesh with a straight rack element of constant pitch; (3) have a worm gear modification; and finally (4) mesh with a

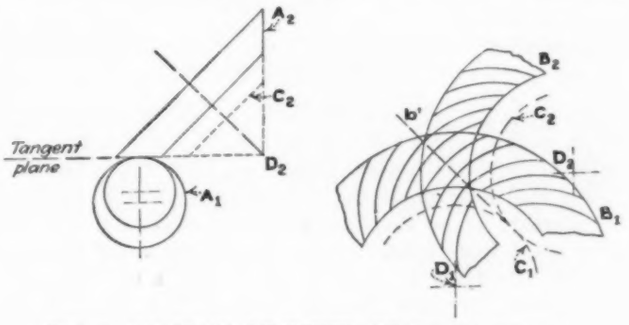


FIG. 1—DIAGRAM OF BEVEL GEARS HAVING A SLIDING ENGAGEMENT

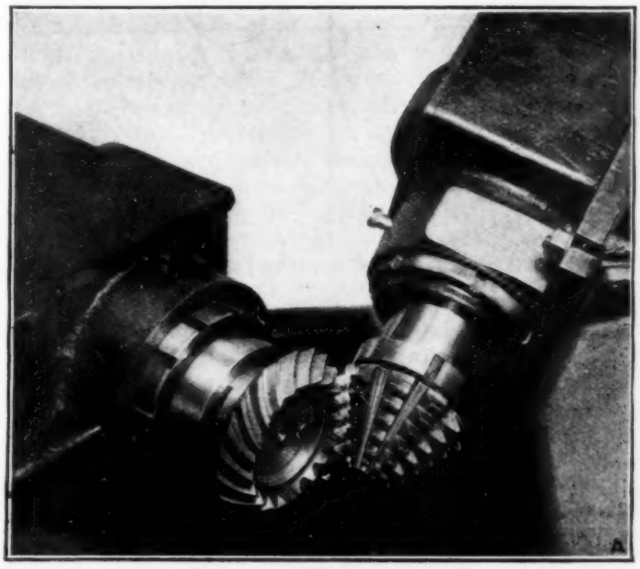


FIG. 2A—RIGHT-HAND TAPERED HOB TAKING A FINISHING CUT IN A RIGHT-HAND SPIRAL MITER GEAR

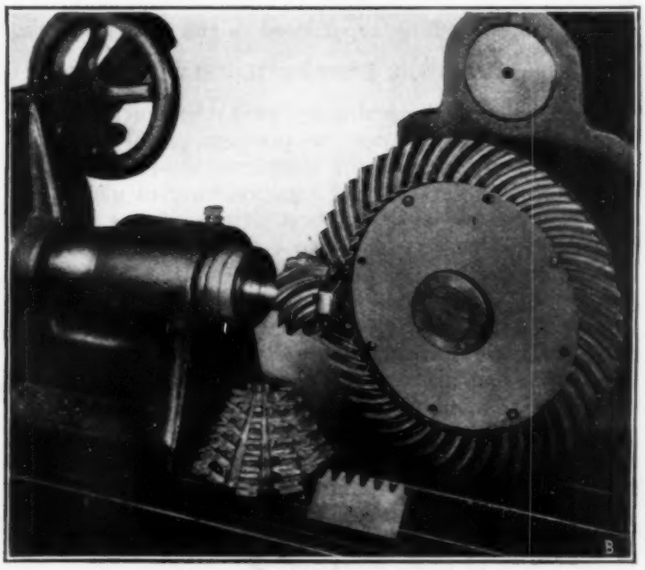


FIG. 2B—AUTOMOBILE REAR AXLE GEAR AND PINION OF THE EXTENDED INVOLUTE TYPE

screw of constant lead, so that they can be generated by the hobbing process. We have found that such a system of bevel gearing exists, and it has a worm gear modification also—the new *hyperboloidal gear* having spiral teeth.

Referring now to the possibility of hobbing such gears, we may reach the following *a priori* conclusions without much difficulty. If a spur gear is hobbed by a spur hob, a conical gear ought to be hobbed by a conical

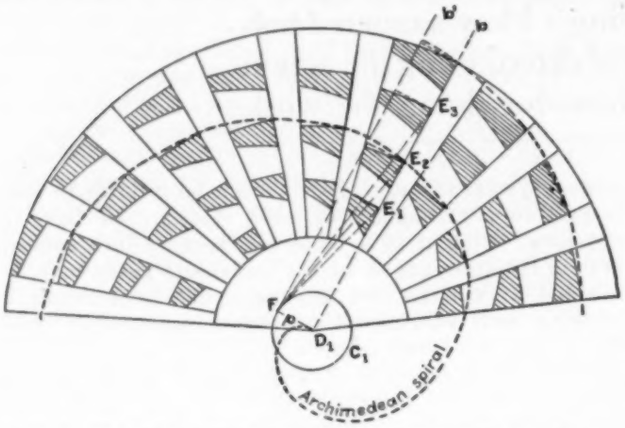


FIG. 3—PLANE DEVELOPMENT OF THE PITCH CONE OF THE NEW TAPERED HOB

hob. Now, as the straight-toothed bevel gear does not mesh with a screw of any description, and cannot be hobbed, the desired bevel gear must have spiral teeth.

We can now push the reasoning one step further. We already know that the hob is conical, and that the gear must have spiral teeth. Evidently when the hob touches the gear these parts must have a common tangent plane, to which the pitch cone of the hob and the gear are tangent on opposite sides. When the hob is rotated, its teeth or threads must slide longitudinally along the spirals of the gear. From this fact follows that the developments of the two pitch cones in the common tangent plane must also slide with respect to each other; that is, they must be distinct, in contrast with the developments of two bevel gears (or crown gears) meshing with the conventional rolling contact, in which latter arrangement the two developments are identical and are fully superposed in the tangent plane.

Approaching the Problem Mathematically

This kinematical peculiarity gave the much desired opening for approaching the problem mathematically, because the meshing of the imaginary developments of the hob and the gear in the common tangent plane is a distorted picture of the actual nature of the contact taking place between the two elements. In that distorted picture such characteristics as the lengths of arcs of the longitudinal spirals, the angles of intersection, and the sliding element of engagement in its full numerical value, are fully preserved; while the rolling element is lost, as well as the factors governing the secondary contact or interferences between two conjugate spiral surfaces. The last two factors must, therefore, be calculated separately, while the really difficult part of the problem, the question of the "odontical conjugacy" of the mating pitch helixes, may be satisfactorily studied from the plane developments only; that is, by means of plane geometry.

Suppose now that two bevel gears A_1 and A_2 in Fig. 1 mesh with a sliding engagement. In that case the two corresponding developments B_1 and B_2 will also rotate about their apexes D_1 and D_2 at a constant ratio, while the base circles C_1 and C_2 will touch each other and roll together like the pitch circles of two mating spur gears. In order that the engagement be correct, the two series of spirals in the developments B_1 and B_2 must therefore be conjugate; that is, the spirals B_1 must be rolled off by means of a certain roller curve from the circle C_1, and the spirals B_2 by means of the same roller from the circle C_2. If the locations of the apexes D_1 and D_2 as well as the ratio of rotation, and the equation of the spiral B_1 were all known, the spirals B_2 could be mathematically determined.

The Tapered Hob

In Fig. 2A a view of the new tapered hob is shown. The hob has an axial rack section and a constant helical lead. The cone angle is 30 deg., while the pressure angle of the rack teeth may vary from 15 to 25 deg., 20 deg. being the preferred angle. Such hobs may be accurately and comparatively easily manufactured in standard machine tools, and they also may be ground on the thread after hardening. It should be noted that the cutting teeth are relieved radially in a direction perpendicular to the side of the cone; that is, at an angle of 60 deg. with respect to the axis of the hob.

At *B* in Fig. 2 are shown set up for testing purposes a spiral bevel gear and pinion for use in the rear axle of an automobile. The gearing is of the extended involute type that will be explained later, the normal

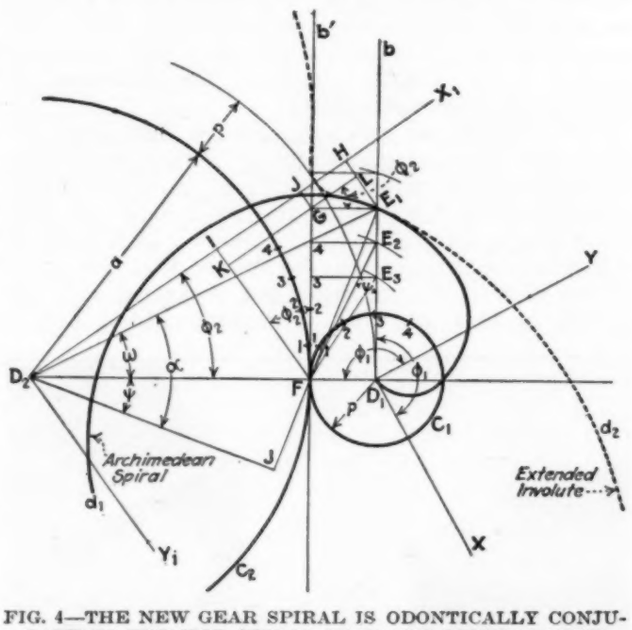


FIG. 4—THE NEW GEAR SPIRAL IS ODONTICALLY CONJUGATE TO THE HOB SPIRAL IN PLANE DEVELOPMENT

diametral pitch is 6, and the ratio 10 to 46. The hob that did the work can also be seen.

The diagram in Fig. 3 shows the plane development of the pitch cone of the new hob, in which the conical helix of constant lead develops into a number of plane spiral segments of constant lead (the so-called Archimedean spirals), while the axial rack sections caused by the gashes become radial lines converging in the apex D_1. It follows from the well-known properties of these spirals that the normals at the equally spaced points E_1 and E_2, etc., on the rack generator *b* all meet

at the same point F, and that the distance $FD_1 = p$ is the so-called "polar subnormal" of the Archimedean series, which distance is always perpendicular to the generator b at D_1. It is also known from geometry that the length of this polar subnormal is:

$$p = \frac{\text{lead of spiral}}{2\pi} \qquad (1)$$

Our immediate object is now to generate the Archimedean spiral series in Fig. 3 by rolling alone; that is, to find the conditions under which the Archimedean spiral may become an odontic curve. Furthermore, the

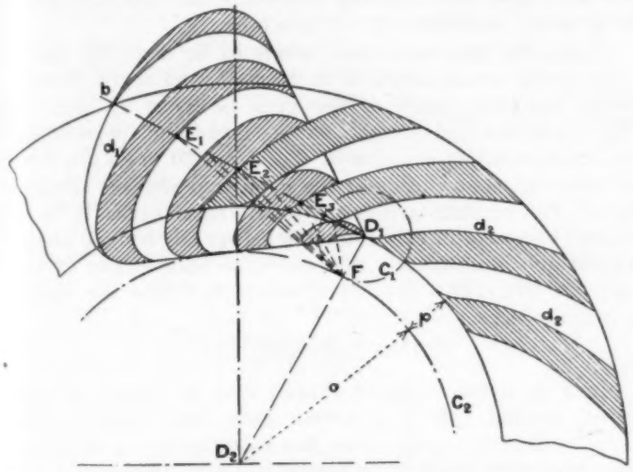


FIG. 5—CORRECT SUPERPOSITION OF THE NEW CROWN GEAR UPON THE TAPERED SCREW, THE GEAR SPIRALS BEING TANGENT TO THE TAPERED SCREW SPIRALS AT ALL POINTS ALONG THE RACK GENERATOR b

roller must contain the entire rack generator b; that is, the series of equi-spaced points E_1, E_2 and the like.

We have found that the new roller by means of which Archimedean spirals may be odontically generated is a parallelogram of width p, one side of which parallelogram is tangent to the FD_1 circle while the opposite side is the rack generator b. Thus, if we roll the line b' without slipping on the circumference of the circle C_1 and assume that the generator b is rigidly attached to former, the points E_1, E_2, etc., will describe Archimedean spirals, having a lead equal to the circumference of the base circle C_1.

This important kinematical property of the Archimedean spirals (which property we believe we are the first to discover) forms the foundation of this method of gear cutting. As already pointed out, the new tooth spirals must be conjugate to the hob spirals in the same sense as two such series of tooth curves of a pair of mating spur gears are conjugate; that is, they must be described by the points E_1, E_2, etc., when the b' side of the b-b' parallelogram rolls on the circumference of an assumed base circle.

The New Gear Spiral

The method of generating the new tooth spirals will best be understood from Fig. 4. The base circle C_2 of the proposed new gear having a radius a is drawn tangent to the base circle C_1 of the Archimedean spiral, having a radius p. The equation of the latter spiral d_1 is evidently

$$r = \pm p\phi_1 \qquad (2)$$

where $r = D_1 E_1$ is the radius vector, and ϕ_1 the vectorial angle.

The conjugate spiral d_2 is traced by the point E_1 when the line b' rolls on the circumference of the C_2 circle, carrying with it the rack generator b. In order to determine its equation with respect to the X_1-Y_1 system of coordinates, we proceed as follows:

$$x = D_2H = D_2I + IJ + JH$$

But, $D_2I = a \cos \phi_2$

$IJ = KG = FG \sin \phi_2 = a\phi_2 \sin \phi_2$

And, $JH = GL = p \cos \phi_2$

From which,

$$x = (a + p) \cos \phi_2 + a\phi_2 \sin \phi_2 \qquad (3a)$$

And similarly,

$$y = (a + p) \sin \phi_2 - a\phi_2 \cos \phi_2 \qquad (3b)$$

The spiral defined by the equations (3a) and (3b) is what we have termed a modified involute of a circle, and has four distinct geometrical forms depending on the value of the modification p. Thus, for $p \gtreqless 0$, the spiral is correspondingly an extended, a common or an abridged involute. A subclass of the last (the abridged) form is the Archimedean spiral for the values $p = -a$. We are interested in particular in those spirals which are capable of meshing with the Archimedean spiral, and hence with the tapered screw of constant pitch.

The base radii of all those spirals may be selected at will, but the modification in each case must be equal in absolute value to the polar subnormal p of the adopted Archimedean spiral. Thus, they may be extended involutes having $+p$ modification, or abridged involutes having $-p$ modification. In the former case the base circles C_1 and C_2 of the gear and hob touch

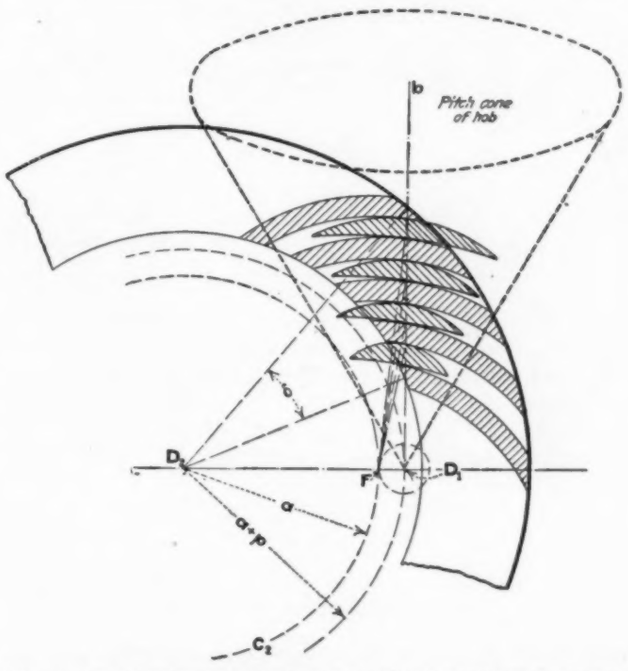


FIG. 6—CRESCENT-SHAPED CUTS OF INCREASING RADII ARE PRODUCED BY THE HOB AT EVERY INSTANT ALONG THE RACK GENERATOR b

each other externally, and both spirals are of the same hand (either right hand or left hand); while in the abridged combination the base circles touch each other internally, and the hands of the spirals are opposite (one right hand and the other left hand). For prac-

tical purposes, we prefer the first or extended combination on account of a more favorable cutting action, because there the spirals d_1 have a maximum amount of sliding with respect to the spirals d_2.

This condition is somewhat analogous to that found in common hobbing governing the hands of hobs and of the generated helical gears. It is a well known fact that in the best practice right-hand helical gears are generated by right-hand hobs, and left-hand gears by left-hand hobs. In that case the rotation of the blank is always opposite to the rotation of the hob, which is a desirable condition in milling. The helix angle a of the new spirals d_2 may be readily determined for any pitch cone radius $D_2 F_1$ from Fig. 4, and is equal to $\omega + \psi$, where,

$$\cos \omega = \frac{a + d}{R} \qquad (4)$$

and,

$$\tan \psi = \frac{p}{r} \qquad (5)$$

where R and r are the pitch cone radii of the gear and the hob, respectively.

It was seen from Fig. 4 that the new tooth spirals d_2 are odontically conjugate to the Archimedean spiral in development. In Fig. 5 the Archimedean spirals d_1 are wrapped on the surface of a cone (the new hob) and a crown gear of the extended involute type is correctly superposed in a tangential relation with the pitch cone of the hob, this relation being determined by the kinematical conditions of the mutual conjugacy. That is, the (highest) rack generator b of the hob is at a distance $(a + p)$ from the gear apex D_2, and the apex

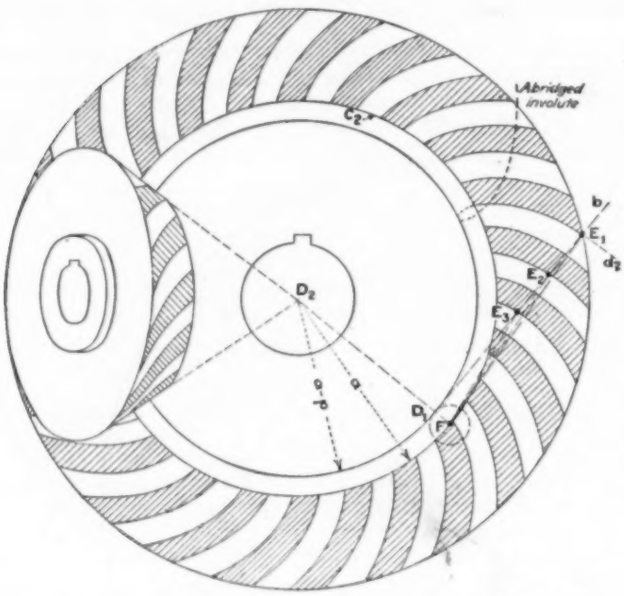


FIG. 7—MESHING CROWN GEAR AND PINION OF THE ABRIDGED INVOLUTE TYPE

of the hob D_1 lies on the circumference of the $(a + p)$ circle.

Now, when the hob and the crown gear are rotated at the proper ratio, the portions of the hob thread in the neighborhood of the points E_1, E_2, E_3, etc., along the generator b will envelop the gear spirals d_2 in their full length. The common normals to the two systems of curves d_1 and d_2 all meet at the point F, the point of tangency of the two base circles.

In this method of gear cutting it is essential that the contact between the hob and the imaginary crown gear be strictly localized along the line $D_1 E_1$, as otherwise a secondary contact would develop between the spirals d_1 and d_2 at some distance from the acting rack generator b, and the generated tooth surfaces would consequently be partially destroyed through interferences. We have accomplished this localization by properly selecting the cone angle of the hob with reference to the customary pressure angles used in practice, and also by taking into account the maximum permissible helix angle of the gears on the large end and the minimum width of gear face deemed necessary to make this type of gearing commercially successful.

Thus, the hob has a cone angle of 30 deg., the pressure angle ranges from 15 to 25 deg., as already stated, while the helix angle of the gear is about 27 deg. on the small end and 45 deg. on the large end, permitting of employment of a width of face from 20 to 25 per cent of the pitch cone radius of the gear, and also permitting of the full or standard depth to the rack teeth. It is of interest to note in this connection that the conical shape of the hob is absolutely necessary, as hobs either of the spur or the crown gear type would mutilate the spiral tooth surfaces.

Characteristic Cuts

In Fig. 6 the crescent shaped cuts produced by the novel conical hob in a crown gear, are shown. The small end of the gear (near the base circle) is cut away in order that hobs of a truncated cone shape may be used. An idea of the actual sizes of the new hobs may be formed from the dimensions of a 6 normal pitch hob used for cutting rear axle pinions and gears for automobiles of medium weight. This hob has a diameter of 5 in. on the large end and 3¼ in. on the small end, a width of face of 2¾ in. (measured along the side of the cone), a single thread and 10 gashes. The length of the polar subnormal p of such a hob is only 0.167 inch.

We have now shown that crown gears may be correctly generated by a timed rotation of the gear and hob alone. For generating spiral bevel gears of a cone angle less than 90 deg., the timed rotation alone is no longer sufficient, and the blank must be rolled over the imaginary crown gear, through an angle δ in Fig. 6. When this rolling occurs, the large end of the hob first engages the large end of the gear blank (while both are rotating) and the contact between the hob and the blank gradually progresses toward the small ends of the hob and blank. When the small end of the blank is reached the blank is fully completed; that is, the teeth are fully generated on their both sides and through their entire lengths. Thus, the method of generation is very simple, as it consists of following three steps only:

(1) Adjust the hob and the blank on their respective arbors so that they will be tangent to a common tangent plane, and the pitch cone apex will be at a distance $(a + p)$ from the gear apex, as shown in Figs. 4, 5, and 6.

(2) Rotate the hob and the blank in a timed relation.

(3) Feed either the hob or the gear about the gear apex D_2 in a circular path through an angle δ.

In Fig. 7 a meshing crown gear and pinion of the abridged involute type are shown. The abridged form of spiral (with the loop) is, however, very seldom used in this system of gearing.

In Fig. 9 the plan view of the new hobbing machine developed for cutting the gears is diagrammatically

shown, disclosing the gear trains and means for adjustment necessary in such a machine. The hob *A* is mounted on a spindle intersecting the common tangent plane *B-B* at an angle of 30 deg., resulting in the fact that the side of the hob facing the gear blank is always parallel to this tangent plane. The hob spindle is mounted in the cutter head *C*, which latter is eccentrically mounted on the face of the large feed cylinder *D*, and is pivotable about the shaft *E* from which the hob is driven. The hob spindle is also longitudinally adjustable in the cutter head *C*.

Thus, the hob may be swiveled about the pivot *E* and also adjusted lengthwise, so that its pitch cone apex may be set to any distance $(a + p)$ from the center line of the machine, as required by the theory. The feed cylinder *D* is rotatable in the main frame of the machine and is driven by the large feed wormgear *F*, acting through the three large screws *G* housed in this gear and engaging the corresponding nuts in the cylinder *D*. The end thrust caused by the cut of the hob is taken up by the accurately finished sides of the wormgear *F*, which act as thrust bearings in their housing.

The object of the three screws *G* is to provide a longitudinal adjustment of the feed cylinder *D* with respect to the tangent plane *B-B* prior to generating. When the machine is cutting bevel gears the screws are tightly clamped to the feed cylinder *D* in a position corresponding to the desired depth of cut, and the blanks are completed by the rotary feed alone. However, when either crown or hyperboloidal gears are generated, the rotary feed is discontinued and the hob is fed slowly into the gear to the required depth by operating the handwheel *H* acting upon the screws *G*.

Thus, the movements of the new machine are the following: The hob *A* is driven from the pulley through the speed change gears *I*, a pair of miters, the spur gears *J*, and the shaft *E*, as shown. The feed cylinder *D*, or rather the large feed wormgear *F*, derives its rotation from the pulley through the worm and wormgear *K* and the feed change gears *L*. The work is rotated by means of the spider of the differential *M* and the index change gears *N*. There is also an equalizing geared connection between the feed cylinder *D* and the work in the form of the roll change gears *O* and the differential locking worm and gear *P* acting upon the sun gear of the differential *M*. This feature makes it possible to change the feed gears *L* at will, or employ a hand feed by rotating the hand wheel *Q*, without disturbing the correct meshing of the hob and gear.

The work head *R* can be swiveled on the top of the semi-circular table *S*, and is also longitudinally adjustable in its slide. When in a cutting position, the pitch cone of the blank must always be tangent to the plane *B-B*, while the apex of this cone must be in line with the axis of the feed cylinder.

A very attractive feature of this method of gear cutting is that all the necessary data in the design of gears, the setting up of the machine, and the selection of change gearing, may be fully and exactly determined by comparatively simple calculations, and correct gears may be produced at once without any previous experimenting or guess work. The polar subnormal *p* is stamped on each hob, as well as the length of the hob pitch cone radius from a given reference or gage circle ground in the large end of the hob. The base radius of the gear may be determined from the following formula:

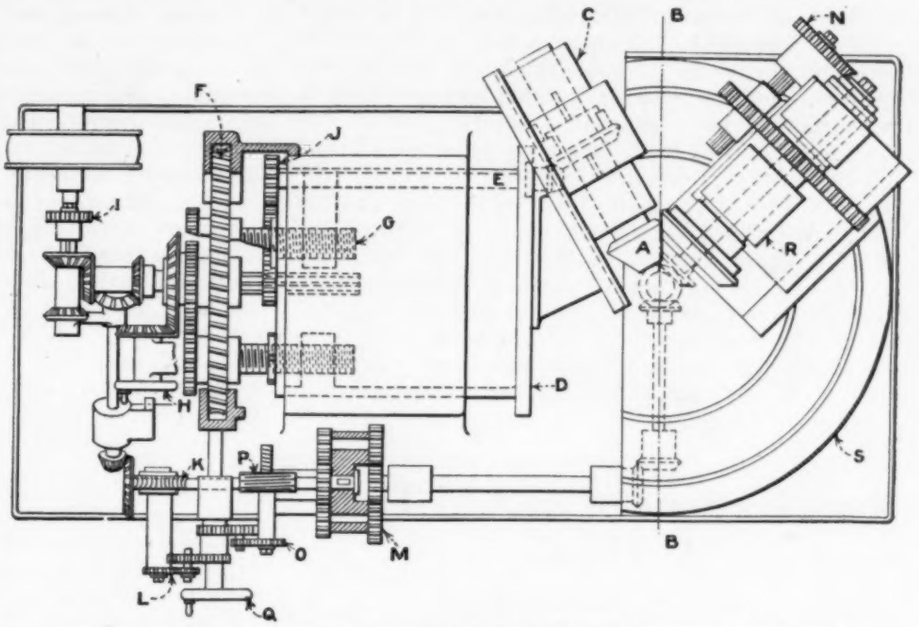


FIG. 8—DIAGRAMMATIC PLAN VIEW OF THE NEW HOBBING MACHINE FOR SPIRAL BEVEL GEARS

$$a = \frac{n}{2P \sin \beta}, \qquad (6)$$

where *n* is the number of teeth in the gear, β the cone angle, and *P* the diametral pitch of the hob, or the rack element. Thus, the hob arbor may be swung to the required $(a + p)$ distance from the center line of the machine, to the right (looking from the large end of the hob toward the center of the machine) when right-hand gears are cut, and to the left when left-hand gears are cut, and the hob apex also may be brought into the rquired exact tangential position. The outside cone of the blank is usually accurately turned parallel to the pitch cone, and may be used as a gaging surface for locating the blank with reference to the tangent plane and for determining the depth of cut which the hob is going to take.

The dimensions of the gear blank may also be very simply determined by consulting the lay-out shown in Fig. 4. In order to find the pitch cone radius of the gear on the large end of the blank, the helix angle

$$\alpha = \omega + \psi$$

is first assumed. As the quantities *p* and ψ in the equations (4) and (5) are usually very small, these two equations may be simplified, and the correct helix angle on the large end of the blank approached within one or two minutes by using the formula

$$\cos \alpha = \frac{a}{R} \qquad (7)$$

From which

$$R = a \sec \alpha \qquad (8)$$

If the maximum helix angle a equals 45 deg., the equation (8) becomes

$$R = a\sqrt{2}, \qquad (9)$$

giving the length of the pitch cone radius.

By this process correct spiral bevel gears may be simply, economically and rapidly generated in one continuous operation. The hob is of such a form that it may be manufactured and sharpened with great precision and at a reasonable cost. The teeth of the new gears have an increasing twist of spiral from the small toward the large end of the gear, a uniform depth, and practically the same normal thickness everywhere. Therefore, the new gear is usually stronger than a straight-toothed bevel gear of a similar size, as the helical form of the teeth has been obtained without a sacrifice in the strength.

As both sides of the teeth, both for the gear and the pinion, are finished during the same cut without the need of resetting the hob or the blank, the operation of the machine is very much simplified. The same class of operators now employed for running the common spur hobbing machines, may be entrusted with the operation of the new machine. The new gears when correctly cut have a contact all over, as the concave and the convex pitch helixes on the mating teeth are exactly alike, and also the transverse tooth curves are correctly generated by an involute rack element. There is a considerable latitude permissible in assembling a pair of such gears owing to the fact that the tooth surfaces are of an involute character both ways.

The new bevel worm and the hyperboloidal worm-gears open a new chapter in the art of gear cutting, and the writer believes that the discovery of those new machine elements will revolutionize our present notions on worm gearing. The two outstanding features of the new worm gearing are that, first, the sliding element of contact may be decreased greatly below that of the 45 deg. helix angle spur worm drive (which form represents at the present state of the art the maximum obtainable theoretical efficiency), and second, the backlash between the worm and gear may be adjusted without changing the center distance.

[Note—This paper constitutes a notable contribution to the art of cutting gears. Valuable work along the same lines has been done by the Gleason Works and by H. E. Taylor, chief engineer of Hotchkiss & Co., Coventry, England. Patents bearing on the subject were granted to J. E. Gleason and A. L. Stewart in 1917 and in 1920; to E. H. Wingquist, a Swedish inventor, in 1918; and to Nikola Trbojevich in 1923.—Editor.]

Recollections of an Old Time Mechanic

By John James Grant

WHEN I had finished my three years post graduate job in Old Bill Clapp's shop in Northampton, Mass., a friend had a place for me as tool maker in the Florence Sewing Machine Co.'s shop. This company was the outgrowth of an old shop formerly making turbine water-wheels and other *accurate* machinery. The manager who was there when I arrived was certainly in a class by himself, as he had no more idea of what was wanted in the matter of tools to manufacture sewing machines, than a fifteen year old boy. One of his hobbies was to come around and measure with a two-foot ivory rule, graduated to ⅛ in., some fine piece of work on which we had used a vernier caliper and say, "Well that will do but we must improve on it."

Our machine tools were mostly ones that had been sent in from the manufacturing department to be rebuilt but we managed to keep them. There were no universal milling machines or grinding machines, and small tools were all home made. The first good lathes we had were two 13 in. and two 16 in. with Dwight Slate's taper turning attachments. They were the first lathes sent out from the Pratt & Whitney shop and were at that date the acme of perfection in design and workmanship. I had the honor of setting them up and a short time afterward had the pleasure of meeting both Mr. Pratt and Mr. Whitney. The acquaintance with these men changed the whole course of my life and there was never a break in our friendship.

I often look at the fine tools in the windows of first class hardware stores and wonder how we succeeded in doing accurate and difficult work with the makeshifts we had. I am not exaggerating when I say it would be a wonder if out of one hundred good machine shops of that day, you could find two 1-in. plug gages that would measure alike, although called standards. The vernier caliper was at that time the universal standard and there were as many differences in any particular size as there were men that set the vernier. The micrometer changed the whole of that, as the general mechanic can set it to one ten-thousandth of an inch.

Those were stirring times and at the closing of the civil war, attention was given to the development and manufacture of many new and accurate labor saving small tools, most of them emanating from gun and pistol factories and the men who had been there employed.

Morse, of twist drill fame, with whom I worked at the Florence shops, had designed machines to manufacture twist drills. After he had gone to New Bedford, Mass., and started a small shop for making the drills, he came to the Florence shop and brought drills of the sizes used there, for trial. It would be laughable today to hear the comments of the tool makers on the drills, and the probable failure of the business of making and selling store drills. After testing the drills for several days as to accuracy, wearing qualities, etc., Morse went back with a good sized order and no more drills, except special ones, were made in that shop.

Soon after that Ed. Beach brought out the Beach drill chuck which was a marvel of accuracy and has never been excelled in workmanship.

The late James M. Carpenter of Pawtucket, R. I., and my humble self left the Florence shop on the same day (I think the first day of April, 1864) without either knowing what the other intended to do, but with the same purpose in view. It has been a question ever since who put the first taps and dies on the market. I started a shop in Northampton, Mass., and Carpenter started one in Pawtucket, both of us making taps and dies. A short time after, I moved my business to Greenfield, Mass., and invented the Grant screw cutting die and the Lightning screw plate. Shortly after that I organized the Wiley & Russell Mfg. Co. which was the nucleus of what is now the Greenfield Tap and Die Corporation.

Standard Machines for Quantity Production

By RALPH E. FLANDERS

Standard vs. special machines for quantity production—Special purpose machines from standard units—Disadvantages of completely special machines—Standard machines for special tooling

THE Production Meeting of the S.A.E., held in Detroit last year, was one of the most interesting technical sessions ever held by any society from the standpoint of the builder and user of machine tools. The program committee, whether from good fortune or design, hit upon one very important general subject—the question of the merits of standard vs. special machines for quantity production.

Two of the papers which resulted called attention to certain factors which limit the usefulness of highly special machines, adapted to the manufacture of a single part only. Among the factors mentioned were the high first cost of special machinery, difficulty of insuring proper functioning of a new machine as compared with one built in quantities over a number of years, difficulty in training operators and repair men to properly care for and adjust a wide variety of non-standard machines, and delay in shifting a shop over to a new design of product together with the expense of the special machinery discarded in the process.

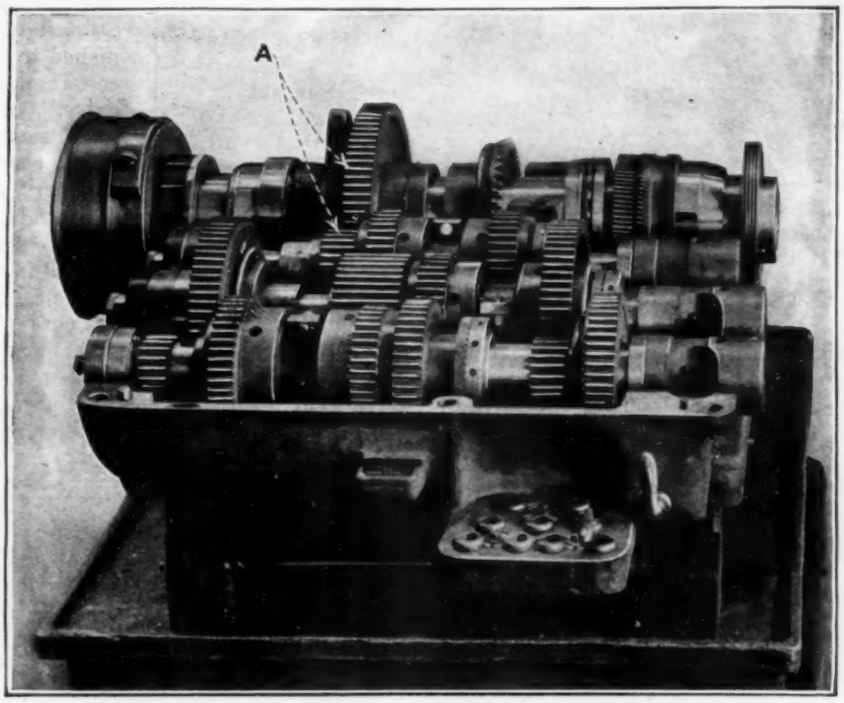


FIG. 1—A TURRET LATHE HEADSTOCK BUILT OF STANDARD UNITS

These and other difficulties are real ones, as the members of this society well know. There have been several cases of large losses from the improper functioning of special machines, and still larger losses from unexpected changes in design of product.

This paper presents the machine tool builders' viewpoint, but it also sets forth the lines of progress which would seem to very nearly meet the conditions of the user's problem. It is hoped that an interchange of views may result in benefit to all parties.

A broad statement of the problem is about as follows: How can machine tools be so designed and built that the user will have the advantage of a machine of proved excellence and low cost, without losing the advantage of special adaptability and economy which the ideal special machine will give? There are at least two methods of approach to a solution. One lies along the lines of building up semi-special types of machines out of standard units. The other consists in the design of a more or less universal foundation machine which is adapted to the making of a particular part by highly specialized tool design.

The failure of hastily designed and built special machinery may come from a number of causes, such as faulty order of operations, unsuitable location and clamping of the work, etc. The most usual cause of failure, however, lies in the weakness or improper lubrication or rapid wear of some essential parts of the mechanism, such as the clutches, feed gears, sliding surfaces, or main bearings. It is difficult for the most skilled machine designer to be completely successful in these features in a new design.

There are some operations where the completely special machine with its attendant difficulties is unnecessary, even when it is desired to have a machine completely adapted to a particular operation on a particular part. For milling operations on cylinder blocks transmission cases, etc., and for multiple drilling opera-

A paper presented at the Production Meeting of the Society of Automotive Engineers, Cleveland, Ohio, Oct. 25, 1923.

tions on similar parts, special machines may be built up from standard units.

Milling machines, for instance, will vary considerably with the design of the product. They will consist in general of a planer type bed, together with housings which carry vertical and horizontal spindles as required by the part to be manufactured. In the case of V-type crankcases spindles must be set at an angle. Such machines as these should be, and usually are, built up from standard units. The spindle, with its drive and housing, need not vary greatly from machine to machine. The feed mechanism may be the same and even the bed and work table may be built in standard lengths and widths. Since these standard units are of tested and approved design, no fear need be felt for the failure of the machine. It may even be possible to rebuild it to fit a change in the design of the part manufactured, at a cost less than the purchase price of a new complete machine.

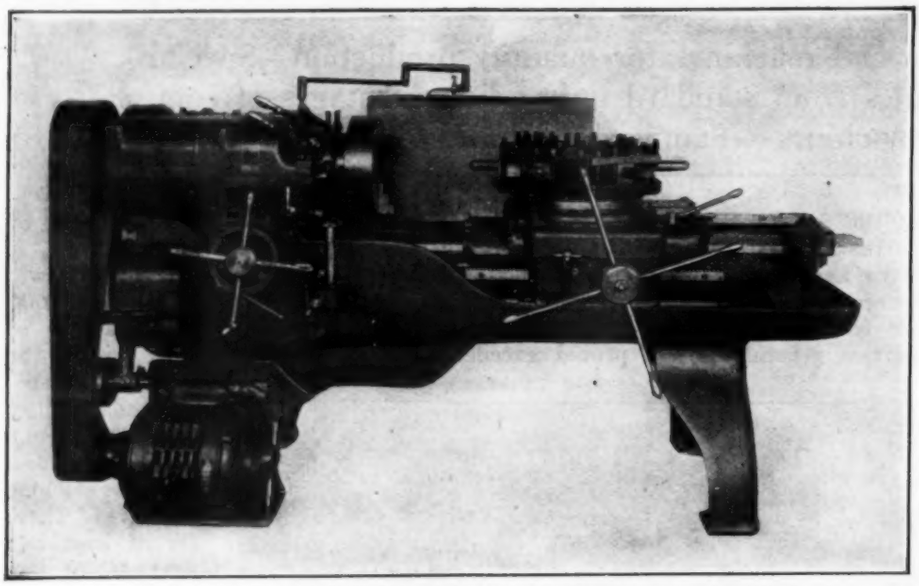


FIG. 2—JONES & LAMSON 15-IN. CHUCKING TURRET LATHE

Built up of headstock mechanism shown in Fig. 1 together with standard feed works, cross feed and apron, and heavy bed, saddle and round turret.

Perhaps I may be permitted to interject here a criticism of one common feature of these machines, though it is aside from the subject. They are often built with tables much too long, in order to take in a long string of work. If we double the length of the table we do not double the output, because it takes twice the length of time to feed, twice the length of time to change work, twice the number of fixtures, and somewhat more for the cost of the machine and the floor space occupied. Sometimes a little is saved by dividing among several pieces the time it takes to get the full depth or width of cut, but this is usually inconsiderable. The long table is probably a relic from planer practice, where the planing of long strings of complicated work is sometimes advisable, in order to divide the tool-setting time between several pieces.

The same principles as given for special milling machines apply also to multiple drills. The spindles themselves, their connection with the driving mechanism, the feed and driving gearing, etc., are proper subjects for standardization; and this may be done and still provide a special machine part. Unless the drill spindles are adjustable in position, however, there is not so much chance of economically rebuilding the machine if the design of the work is changed.

As an example of this first scheme of standardization I am using one of the products of my own company as an illustration. The "J & L" turret lathe is now being built to meet the requirements of a wide range of specific machines to meet specific purposes, but built up in each case from a small range of standard units.

The headstock shown in Fig. 1 is, briefly, composed of ball-bearing transmission shafts, carrying multiple-disk friction clutches and heat-treated gears, all running in oil. The same construction is used for small-diameter high-speed work as for large-diameter heavy-duty work by changing the gear ratio at *A*. This gives a more powerful drive than is needed for the light machine, but it does no harm, and on account of the large production of this standardized drive it can be furnished to the customer at less cost than a lighter but special drive. Except for a minor attachment on one shaft, any shaft complete with all its members can be lifted from one headstock and put in another. The same is true of the spindles.

Three forms of turret are provided. One is small and quick acting for light cuts and another, shown in Fig. 2, is heavier for the most severe service. A square turret is also provided to carry two sets of tools for a double-spindle machine, or one set of tools properly supported for large-diameter work. A plain saddle or tool table for simple operations may be provided.

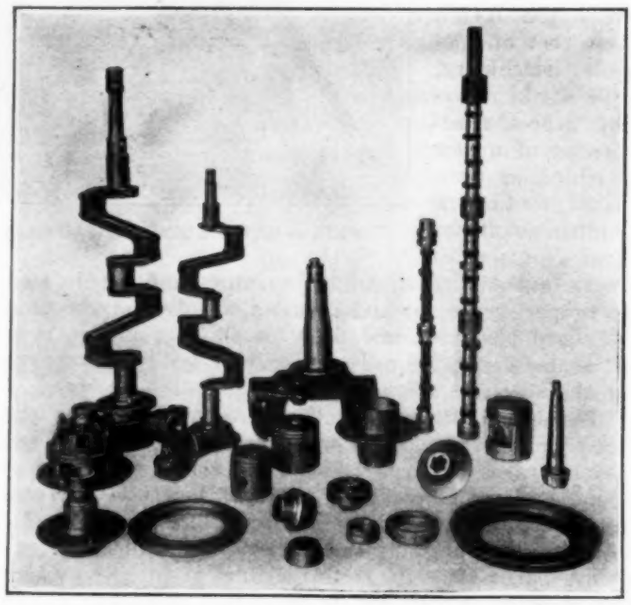


FIG. 3—GROUP OF AUTOMOTIVE PARTS SHOWING WIDE RANGE POSSIBLE ON ONE STANDARDIZED MACHINE

without the turret, on either the single- or double-spindle machine.

The following standard elements are employed:

3 Beds
2 Headstocks
1 Driving mechanism
3 Spindles
1 Feed mechanism
1 Apron
3 Saddles or turret slides
3 Turrets

In various combinations these elements produce the following special adaptations:

(1) 2¼x24-in. bar turret lathe
(2) 3x36-in. bar turret lathe
(3) 12-in. chucking turret lathe
(4) 15-in. chucking turret lathe
(5) 17-in. chucking turret lathe
(6) 10-in. double-spindle turret lathe
(7) 10-in. double-spindle production lathe

This scheme of design and construction is capable of wide application, and will result in advantages to both maker and user.

In Fig. 3 is shown a group of automotive parts on which a large amount of lathe work is to be done. There are included cam shafts, crown gears, pistons stem pinions, steering knuckles, and cluster gears. Some are large in diameter and short; some are small in diameter and long. Some have holes in them and some are solid. It would seem quite difficult to devise a machine capable of satisfactorily performing the

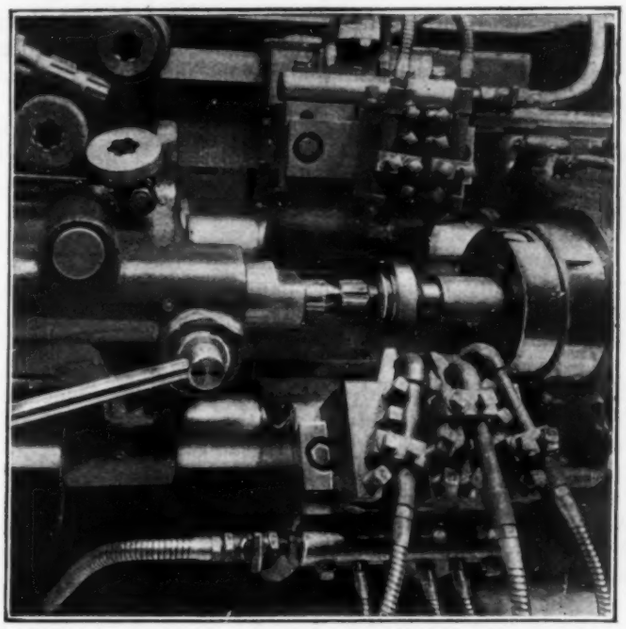


FIG. 5—FAY AUTOMATIC LATHE SET-UP FOR TRANSMISSION GEAR. STANDARD TOOL HOLDERS USED

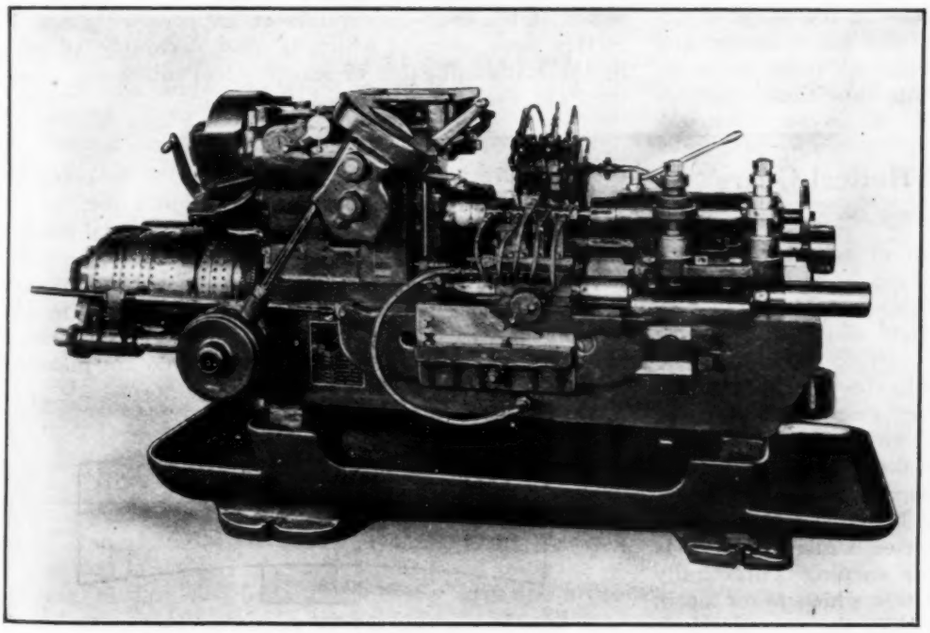


FIG. 4—FAY AUTOMATIC LATHE WITH STANDARD BED

turning operations on all these parts, with the standards of accuracy and production required for intensive manufacture, yet a considerable measure of success has been obtained by following the second of the two principles stated earlier in the paper.

The Fay automatic lathe, shown in Fig. 4, is a machine which has been developed over a period of years from very primitive beginnings. This development has been a true evolution, in that it has been determined by the character of the work offered to it, instead of being the result of careful predetermination on the part of the designer. The fact that it was possible to adapt it to the wide variety of work indicated is the interesting feature of the machine, and a most important one it is for the user.

In the first place the machine is made in three lengths of bed. The standard bed is shown in Fig. 4 and is used for short forgings and work held on arbors. A short bed machine is used for chucking operations, and a long bed machine for long shafts and forgings. The latter carries two carriages and two or more back arms when necessary. With the exception of the bed, front slide, etc., these machines are identical in mechanism and in all their separate parts, and a wide variety of work is handled on one standard design of machine.

As necessary steps in the standardization process the following should be noted:

1—Rigidity of structure and strength of drive and feed mechanism sufficient for the heaviest work it is planned to do. This will make a machine more powerful than needed for the smaller work, but the quantity production of this standard machine will permit a price to be quoted in competition with lighter machines.

2—Universality of tool movements is provided. Note the mounting of the carriage on a swivelling bar, and its control by the sliding former at the front of the bed. The back arms are likewise mounted on bars and controlled by formers so that combinations of turning and feeding movements are possible. Almost always higher production, or better finished work, or both, are

obtainable by movements a little more complicated than the simple "turn and face" motion. Certain operations may also be done which would otherwise have to take a separate operation.

3—The development of standard toolholders which are adaptable to a wide range of work. Fig. 5 shows a set-up for machining a typical sliding transmission gear, standard toolholders being used.

4—The development of standard attachments which vary and extend the capacities of the machine so that specially designed mechanisms or machines are unnecessary.

The Fay automatic lathe, it seems to me, in its present standardized development, offers an apportunity for the proper relationship between the machine designer and manufacturer on the one hand, and the automotive production engineer and tool designer on the other. It is the office of the machine man to furnish a strong, reliable, versatile mechanism as a foundation, and to do this requires years of development with some trial and error. It is not to be done in a day, or to order for quick delivery, if satisfaction is expected.

It is the normal function of the user to mount upon this standard mechanism special equipment which shall make the machine, to all intents and purposes, a special machine for the particular operations and product desired. This tooling likewise demands judgment and wide experience, but it is capable of much more rapid development than the machine itself and, unlike the machine, may be altered from day to day.

It is one of the standing grievances of the machine builder that this special tool design is so often left to him, when it could best be done in the shops of the user. As between two men of the same ability and experience, the one working where the tools are to be used has the advantage. Working conditions, methods of inspection, condition of forgings, all affect the ultimate tool design in ways which it is difficult for the absentee engineer to take account of. It is true, of course, that the tool designer on the staff of the machine builder has the advantage of being a specialist on that machine, but that is his only point of advantage. If the user will concentrate on a small variety of standard machines, his tool engineer may become a specialist also, instead of spreading his activities over a hundred sizes, types and designs.

The advantages thus far urged for the standardized machine tool are, therefore, perfected design, a better machine for the money, and this last point of permitting the tool engineers to specialize and thus do better work.

The fewer kinds of machines needed with standardization bring the following benefits also: Greater familiarity of staff with upkeep and adjustments. Fewer repair parts to carry in stock. Greater flexibility in assignment of work and shop layout. Less expense in changing design of product.

From the standpoint of management of employees there are the following advantages: Fewer kinds of operators to train for repair, adjustments and for operating. A man once trained can be used on a greater percentage of the machines in the shop. Training can be standardized and men taught more easily.

Some of these advantages affect the direct labor cost; others affect the overhead. The wise manager is giving particular attention to the latter division of the cost of manufacture, for of the three primary elements in cost—labor, material and overhead—it is the latter which is the most susceptible of improvement; and it is this same element which is most favorably affected by the standardization of machine-tool equipment along the lines we have mentioned.

Precautions for Cast Helical Gears

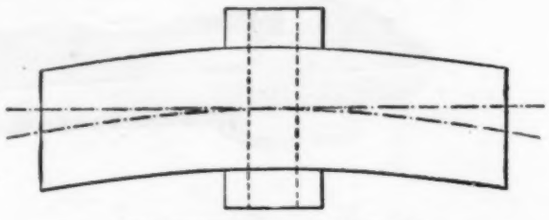
JOHN S. WATTS

When a design calls for a pair of helical gears with cast teeth, that is, the teeth are not to be machine-cut, there are certain precautions which should be taken to insure a satisfactory job, over and above those necessary for plain cast gears.

While the pinion will generally be a good casting, truly circular and running true sideways, the gear, especially if large in diameter, will practically always be warped. The accompanying sketch shows, exaggerated, the way the casting will warp. Although the warping is generally not so bad as to be noticeable when the gear is at rest, it can be detected while the part is in the lathe being machined. This warping is practically unavoidable, as it is due to the side which is on top in the mold cooling more quickly than the side which is underneath and which, being buried more deeply in the sand, is bound to retain its heat longer.

The effect of this warping in a helical gear is that only one-half of the width of the tooth will be in action, and that the working half will be alternately on one side of the gear and then on the other as the gear revolves. Further, as the pinion wears more quickly than the gear, the pinion teeth will be worn away from the true pitch rather than the gear teeth wearing down to a true bearing, and hence the pair of gears will become worse with wear.

Where it is desirable to use helical gears, but not commercially practical to cut the teeth, it is essential that this unavoidable warping be allowed for, which can best be done by allowing a slight longitudinal motion of the gear or pinion, or both. Generally, the pinion should be the sliding member, as being much lighter it will move more freely The total weight to be moved will be only that of the pinion and its shaft, which should be made as short as possible. I do not mean to



WARPING OF A CAST GEAR

have the pinion slide on its shaft, but to have the shaft free to move longitudinally in its bearings.

Whether it is best to have the gear or the pinion do the sliding can only be determined by a study of the question for each machine, but it is evident that the less the weight to be moved, the better. Allowance must be made for the fact that the gear will move sideways only twice per revolution, while if the pinion is to slide it must do so as many times more per minute than would the gear, as the ratio between the gear and the pinion.

Some Ideas for the Planer Department

By Donald A. Hampson

A SIMPLE means of protecting the planer table against the scoring it too often receives from rough casting being shoved over its surface is shown in Fig. 1. Many shops use planks and boards for this purpose but a collection of such is unsightly, takes up a lot of room and often the planks or boards will be shoved along with the casting and allow the latter to do practically as much damage as if the boards were not there.

The bars shown are of ⅜-in. square section, or larger,

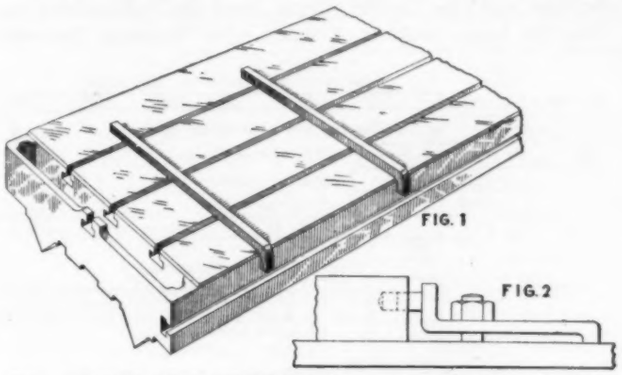


FIG. 1—BARS FOR PROTECTING THE SURFACE OF THE TABLE. FIG. 2—FINGER CLAMP FOR LOW WORK.

and have one end turned down to stop against the side of the table and thus prevent them from being shoved along with the work. Being square, they will not roll over and become displaced as would round bars. Their height is sufficient to allow any irregularity of the casting to clear the surface of the table, yet they are low enough to permit the planer hand to ease the casting down upon the table without difficulty when they are to be removed. Two of the bars will suffice for any but the largest castings, and when they are not in use they may be hung up out of the way.

One of the most useful accessories around a planer is a small pinch-bar, and for the setting of heavy work it is indispensable. For castings that do not weigh over one or two tons a bar 15 in. long of ⅝-round or flat-sided stock of equivalent section, is large enough. The forged end should be flattened to a comparatively thin edge and this edge should be kept in good shape by frequent grinding or redressing as it becomes rounded by continued use.

One of the worst habits of the average planer hand is that of collecting great quantities of material—packing, clamps, odd bolts, etc. These, with the necessary working tools, litter up the surface of the table and end pockets and often overflow the shelves and cupboards provided for storage. Roughly speaking, four bolts each of a half-dozen lengths should suffice. Two posts in front of the work are better than a dozen bolts and clamps that hold by friction only. Strict adherence to this principle makes it unnecessary to keep a hundred odd bolts around and the same policy may be advantageously applied to clamps and blocking.

Drop forged clamps, now obtainable on the market, are much superior to the home-made kind and for supporting work, good jacks are far better than setscrews tapped into any old piece of cast iron. For packing, there should be a supply of sheet metal shims and these, to be most useful, should be kept in a case having separate pockets for each thickness. A number of small wedges will also be found very useful.

When the planer is used almost entirely upon low work, clamps of the kind shown in Fig. 2 are best to use. With such clamps the nuts of the holding bolts are below the level of the surface to be planed and thus much time is saved that would otherwise be lost in arranging tool clearances, grinding tools and repairing bolts after an accident.

There need be but four or five articles kept upon the table of a planer. These should be: a brush of generous size, a small shovel or scoop for removing chips, the pinch bar before mentioned, and a double-end wrench to fit the nuts of the clamping bolts, reversing dogs of the table, and clamps of the tool holder. Contrast this with the untidy appearance too often presented by the table surface where the planer hand is obliged to clear the way for a new job in much the same fashion as he would shovel a path through new fallen snow. The time wasted in pawing a way through unnecessary equipment increases as the square of the number of pieces, and a careful study and elimination of superfluous junk will sometimes produce astonishing results.

Broad cuts are usually applied to the finishing of surfaces of cast iron, with feeds ranging from ⅛ to 2 in., and to conserve the sharp edge of the tool it is desirable to lift the latter over the work on the return stroke. There are many devices for doing this automatically but they are quite likely to be misplaced, out of order, or to necessitate too long an overrun of the tool; therefore a careful operator relies to a large extent upon the hand method.

To avoid the long reach necessary on wide work and to make the lifting less laborious, a stick can be thrust under one of the tool clamps and requires no time to set up, while with its assistance the operator can lift

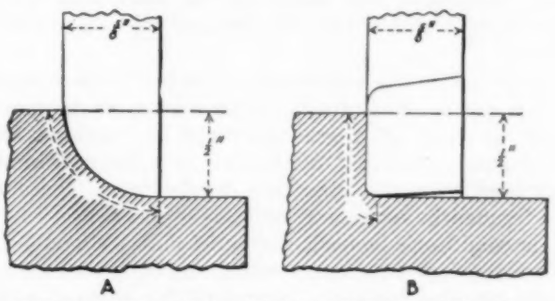


FIG. 3—RIGHT AND WRONG SHAPES OF TOOLS

the heaviest tool block with ease, even at the farther side of the table.

Much has been written about the shape of tools for cutting metal, but it is still true that many machinists who grind their own tools do not grind them intelligently. The shape of a tool may influence production and finish to a marked degree.

Two ways are shown in Fig. 3 to grind a tool for the rough planing of cast iron. At *A* is shown the common way. Though the tool may have been ground correctly in the first place, successive sharpenings have reduced it to the form shown, where the cutting edge follows around the bit from side to heel in a sweeping curve. If side rake is desired on such a tool it can be secured only at the expense of top rake or by the inclination of the tool bit in the holder.

A tool ground thus will work all right in many cases but if the casting is frail it will spring badly, while the tool will eat up a large percentage of the power without a corresponding increase in the rate of production. The form shown at *B* is correct.

It will be noticed that both tools shown in Fig. 3 are of the same size and are taking the same cut, but under equal conditions the one at *A* will consume more power than required by the other because the length of the chip is about 25 per cent greater. Further, there is a downward component to the thrust that springs the work unduly when passing over unsupported parts of the casting.

That the partial loosening of bolts before taking the finishing cut over a casting will produce a true surface is a fallacy that is deeply grounded in the minds of most machinists. Loosening the bolts is a step in the right direction, but it is only a step. Moreover, it is a tacit admission that the work was not properly supported in the first place.

Every casting springs after the surface skin is taken off, and may spring more when deeper cuts are made. Usually, the whiter the iron (the harder the casting) the more it will spring. After *completely* loosening the holding bolts the casting must be repacked and then clamped without further springing. An inadequate support never produced a true surface.

What Is Your Export Ratio?

By W. H. Rastall

Chief of Industrial Machinery Division, Department of Commerce

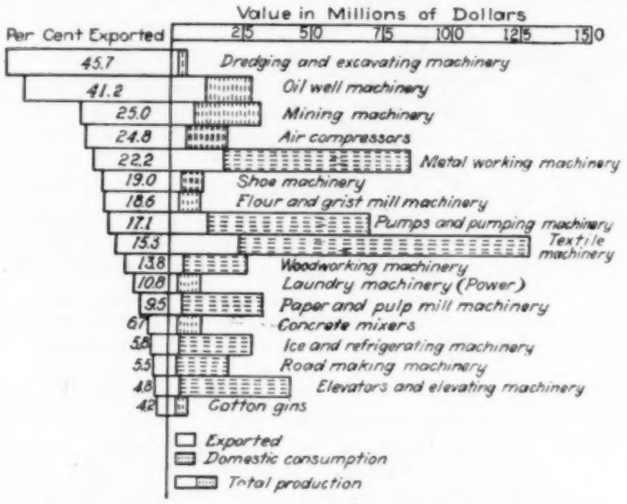
WHY should manufacturers of air compressors have better export business than manufacturers of concrete mixers? At first thought one might expect the advantage to lie with the concrete mixer manufacturer because of the nature of the work and the surroundings under which his product is commonly employed.

Why should the percentage of export orders secured by a manufacturer of excavating machinery be twice as great as that of a manufacturer of machine tools? American excavating machinery usually represents a very high state of engineering development. These units are frequently very costly and one might expect that the labor conditions in most foreign countries would make it unnecessary to employ machinery of this character, while machine tools are necessary for a great number of manufacturing operations and would seem to be in more general demand.

A great many similar questions naturally arise in considering the accompanying chart, which indicates the total volume of production and the percentage exported, applying to certain classes of American industrial machinery. It is interesting to speculate whether the situation illustrated by this diagram is the result of fundamental conditions or merely expresses the comparative business ability and sales effort manifested by the managements of these different producers of machinery.

Conditions have now reached a point where American machinery manufacturers should give very careful attention to their export business. Unusual opportunities are to be found in these foreign fields because Germany appears to be almost eliminated as a competitor. Before the war Germany furnished perhaps 45 per cent of the machinery that went into international trade, and since the Armistice there have been times when the depreciated condition of the mark gave German manufacturers a peculiar advantage in this trade. That situation has now passed, and in great measure German prices already exceed world market levels. Experience shows that deliveries from German manufacturers are slow and frequently uncertain, and in a great many ways it is difficult for foreign buyers to buy in Germany on a basis that is at all satisfactory. Business that formerly went to Germany will more and more fall into the hands of others.

Although there are a number of countries in the world that produce machinery for export, the countries of most outstanding importance at present are Great Britain and the United States, and the indications are that the large volume of machinery business formerly



PRODUCTION AND EXPORTS OF CERTAIN CLASSES OF INDUSTRIAL MACHINERY IN 1921 AS DETERMINED BY THE DEPARTMENT OF COMMERCE

secured by German manufacturers will now be awarded to either British or American producers.

American engineering and American machinery are distinguished in the world's markets for their superiority. Americans are noted for their engineering achievements; but because of this superiority American machinery is usually higher in price than similar equipment secured from foreign sources, and must be marketed on a quality rather than a price basis. In other words, this trade that formerly went to Germany will now pass to British manufacturers, unless American products are supported by constructive sales effort of such character as to demonstrate that American equipment is worth the price asked—and more. Manufacturers should now organize their sales effort along such lines as will accomplish this result.

Export business is becoming more and more essential to the prosperity of the individual manufacturer. The accompanying chart shows that it is vital for manufacturers of dredging and excavating machinery. The difference between a satisfactory and an unsatisfactory export ratio can easily represent the difference between profit and loss on the year's balance sheet. Manufacturers have a very definite opportunity to improve their export ratio, and it remains for them to make the sales effort necessary to secure these results. The present international situation provides an unusual opportunity.

American Grinder Co. Spur Gear Grinding Machine

By A. J. OTT and C. L. OTT

A recently developed machine of the pure generating type—Grinding wheel functions as one tooth of an imaginary rack—Automatic relative motion of wheel and work

As the plain cylindrical grinding machine is now in such general use for grinding interchangeable cylindrical parts to limits, so after years of development work, a spur gear grinding machine has been perfected that will grind involute teeth on a production basis, produce precise duplication of tooth contour, accurate spacing and smooth finish, so that these ground gears assemble interchangeably and run quietly.

This machine is now being built and marketed by the American Grinder Co., 6543 Benson Street, Detroit, Mich. Its capacity ranges from 2- to 8-in. pitch diameter, and any pressure angle up to 25 degrees.

This machine is of the pure generating type, the action being that of rolling a gear along an imaginary rack with the grinding wheel as one tooth of the rack. The action of the gear and the imaginary rack is shown in Fig. 1, diagrammatically.

The machine, with water guard in place covering the wheel and work, is shown in Fig. 2. You will notice the general compactness, and the single self-contained pulley drive. The wheel spindle is journaled low on the wheel slide column, thereby getting the heavier and high speed member down to terra-firma. It has a lateral feed adjustment of 1½ in. and is provided with double end thrust ball bearings. The main bearings are Lumen bronze, tapered on the outside for wear adjustment. The feed is controlled by the 12-in. handwheel, which is provided with a micrometer adjustment and positive stop.

Method of Truing Wheel Surface

The flat surface of the grinding wheel at right angles to the wheel spindle does the grinding, and is kept true with a double worm and worm wheel driven truing device. The reduction is such that, while rotating the hand wheel at a moderate speed, the movement of the diamond is slow, which is necessary to secure a smooth and true grinding surface. This design of wheel allows 1¼ in. deep surface wear or truing.

The wheel head is arranged to swivel to right or left of the center up to 23 deg. This is particularly advantageous on pinion gears, that is, gears with stems, since the stem is located in the holding arbor while grinding either the drive or coast side of the teeth. Without the swiveling feature, special outboard centers would have to be used, a rather inconvenient arrangement and in some cases not at all practical. The swiveling is also a very desirable feature on some cluster gears. The wheel, of course, is reversed as is also the diamond holding arm.

The wheel head is shown swiveled to the left through 14½ deg. in Fig. 3, and is grinding an 18-tooth, 6-pitch stem gear on the coast side. This is the position in which the wheel head is mostly used, especially on all gears that can readily be reversed in the arbor. You will notice that the gear is above the wheel at a suitable loading height and very accessible. The water guard has been lifted and rocked up out of the way.

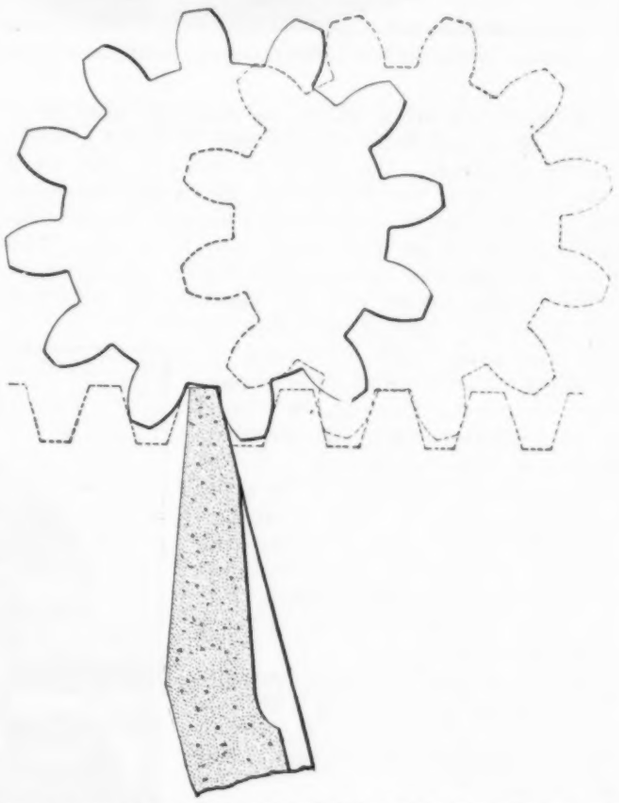


FIG. 1—DIAGRAM SHOWING GENERATING PRINCIPLE OF GEAR GRINDING MACHINE

The clocklike mechanism automatically stops the work carriage when the last tooth of a gear has been ground, and also the wheel if desired. It is quite customary to set the stop at twice the number of teeth

Abstract of a paper presented at the Production Meeting of the Society of Automotive Engineers, Cleveland, Ohio, October, 25, 1923.

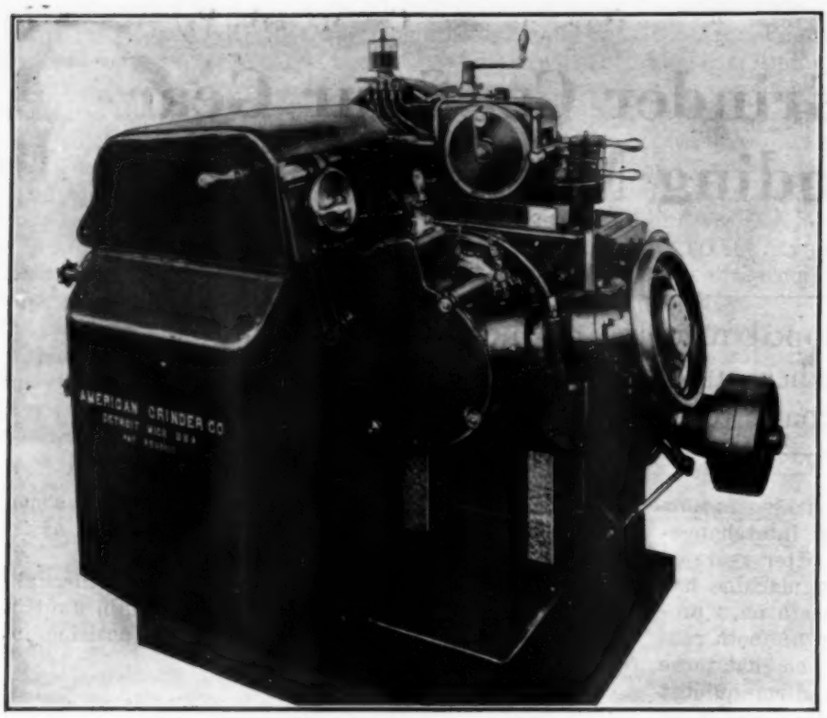


FIG. 2—AMERICAN GRINDER CO. SPUR GEAR GRINDING MACHINE

of the gear you are grinding, to allow the gear to go around twice and make what might be called a rough and finish grind. The wheel is sparking out, as it were, since it is not fed toward the work the second time around. As the last tooth is finished the carriage automatically stops, and wheel also if so set. This allows the operator to run two or more machines.

The carriage stops with the gear out of the wheel, that is, to the right of the wheel, so that the arbor can be loaded or unloaded without wheel interference. The gear must, of course, be located to mesh correctly with the grinding wheel and to do this quickly, a slotted locating ring is attached to the arbor as shown in Fig. 4. With a substantial knife gage inserted in the ring slot and between two teeth, the gear is positioned in proper relation with the wheel and the machine is ready to start grinding again.

The work spindle is taper journaled in Lumen bronze bearings with flood lubrication, mounted in a carriage which is driven by a drum cam located in the bed.

The general motion of the work spindle is obtained by means of thin steel tapes winding and unwinding on a pitch diameter circle or segment as the carriage is driven forth and back. This mechanism is at the rear of the work spindle. There is practically no load whatever on these tapes, since they simply oscillate the work spindle, and this enables the carriage to be driven at the same rate of speed for small pinions as for large gears. The tapes are 1¼ in. wide and only 0.008 in. thick. One end of one tape is attached to the segment and the other end to the tape bar, the other tape being attached in the reverse position. Screw adjustment is provided so that the tapes hug the segment snugly and produce uniform duplication of the tooth contour.

The index mechanism is very simple and is also located at the rear of the work spindle. Hardened and ground notched plates are used, having the same number of notches as the number of teeth on the gear to be ground. The notches are ground and lapped to very close limits to secure accuracy of tooth spacing. It requires less than a second to index from tooth to tooth and the grinding times vary according to the carriage change gears used. We usually supply two pairs of change gears to grind one side of the usual transmission gear tooth in 5 or 6 seconds, according to the accuracy, finish and production desired.

The groove of the carriage driving cam provides a smooth and suitable reversing drive, thus eliminating entirely load-and-fire reverse mechanisms, clutches, and their attendant troubles. The stroke or travel of the carriage is adjustable to suit the pitch of the teeth, also the position of the carriage in relation to the wheels.

Correct tooth contour of the meshing gears and accurate spacing with a smooth grinding finish produce quiet running gears. Slight variations of tooth contour can easily be made by giving more or less angle to

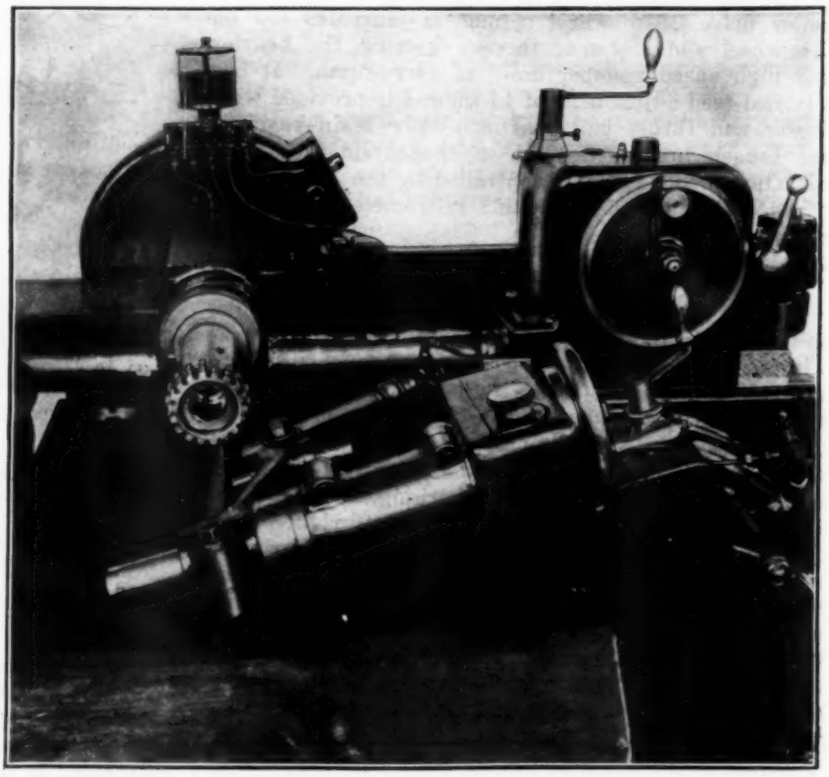


FIG. 3—GRINDING WHEEL HEAD SWIVELLED AT ANGLE OF 14½ DEGREES

the wheel, and also by varying the diameter of the pitch circle or segment.

Really economical production of transmission or similar gears is attained by roughing out the teeth to about 0.005 in. oversize tooth thickness depending on backlash desired, hardening, grinding the hole or stem, then grinding the teeth. The pitch line will then be concentric with the hole or bearing. The finishing can now best be done by grinding after hardening, and in about the same time or even less time.

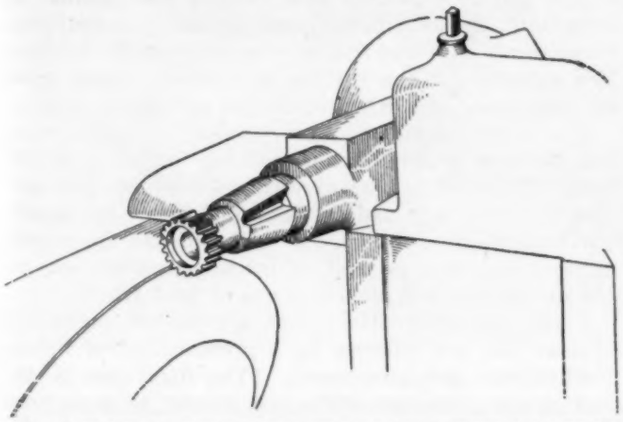


FIG. 4—SLOTTED RING USED TO LOCATE WORK ON ARBOR

National Screw Thread Commission Considers Wire Gages

At a hearing held in New York on Oct. 8, the National Screw Thread Commission discussed with manufacturers and users of wires and sheets the feasibility of adopting the decimal gage series tentatively proposed by the Commission and published in the *American Machinist*, Feb. 15, 1923.

It was the consensus of opinion of those represented at the meeting that in the present use of wire and sheet metal gages much less confusion exists than is generally supposed by those not entirely familiar with trade practice; and that the introduction of the proposed decimal gage series would tend to confusion rather than simplification. It was believed that the suggested decimal sizes would not be adequate to replace the several gage series now in use, and that many of the suggested sizes do not appear in any of the gages now in use and would therefore be special.

Several speakers made the point that gage numbers should be used only to designate approximate or nominal size, and that in all specifications, orders, drawings, etc., the actual decimal diameter or thickness should be stated.

From the discussion it appears that in the nonferrous group the American (Brown & Sharpe) gage is in practically universal use; while in the case of ferrous products conditions are not so well standardized, several gages being used, each in a more or less well defined field.

The steel wire gage (Washburn & Moen), is used for a large percentage of the total tonnage in ferrous wires, and the U. S. Standard gage for sheets, several other gages are used on special products such as tubes, music wire, twist drills, and drill rod.

The Commission will study the situation further before making recommendations.

How Salesmen Can Meet the Price Obstacle

(Business Research Bureau, LaSalle Extension University)

"What's the price?" asks the prospective buyer, and then it is up to the salesman whether price is going to be an obstacle or not. If the salesman works correctly, price is not necessarily an obstacle; but if his practice is faulty or if he has not succeeded in arousing the desire to possess, he may lose the sale because the prospect may be unwilling to pay the price.

As a rule, when a prospective purchaser asks the price of anything it is because he is interested and because he is turning over in his mind the question of whether he is able to pay the price. If the salesman himself thinks his price is too high—and a good many salesmen do—his prospect is very likely to agree with him, because the salesman will be apologetic about his price. The salesman who thinks his price is too high is easy to turn down.

The first essential to the effective handling of the price problem is that the salesman thoroughly convince himself that his price is right. Then his attitude toward the price will not be shaken by prospects who say that they can buy the same thing for less elsewhere. He will often correctly size up this statement as no more than an attempt either to get a lower price or to get rid of him, or as showing that he has as yet not convinced the prospect of the merits of the proposition.

Most standard products and commodities today are priced on a basis of their cost to produce, handle, and sell. The salesman who feels that the cost of what he sells is higher than it should be is usually deluding himself. No price is too high if the service rendered by the article or the profit achieved through the article justifies it. The salesman should investigate his prices and find out how they are arrived at, which will justify them in his own mind and convince him that the price is fair. Then when he talks of the price, his voice will have a ring of confidence which will go a long way toward convincing the customer.

Selling on Production Rather than Price

There is only one basis upon which price should be judged, and that is that the price is never too high if the customer can secure a net gain by purchasing the goods. The initial cost may be high but the net gain to the purchaser, even if spread over a period of time, is justification for the expenditure. In order to convince the prospect on this point the salesman must satisfy him by actual test, demonstration, and comparison of figures. Arguments that appeal to his reason and good judgment should be advanced and he should be convinced that the benefits he can or will secure through purchase of the product really outweigh the price.

The second essential to effective handling of the price problem is to make sure that the prospective purchaser knows what he is going to get in exchange for the price before he is told what the price is. If the prospective buyer has a basis on which to make a comparison between the price and what he will gain through buying, it will be easier to convince him of the net gain than if he were told what the price is without having such a basis for comparison. When he is thoroughly convinced of the net gain (service or profit greater than the cost) to be secured by buying, he will buy—provided that he is able to pay the price.

Book Reviews

Foundry Work. By R. E. Wendt, Head Instructor in Foundry Practice, Purdue University. Two hundred pages, 5x8 in., well illustrated, cloth boards. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $2.

A text on the elements of foundry practice suitable for schools, colleges and foundry apprentices. The author has adhered to his aim of treating only the elements of foundry practice, although careful study of the text, a complete mastery of the problems it contains, and supplementary reading, observation and catalog study will give a good general working knowledge of foundry practice. Although the author does not say so, it seems evident that he aimed to keep away from preparing a large book of appearance forbidding to the student eye, certainly a point worthy of consideration in selecting a school text.

There is a noticeable absence of unessential detail that the student would in all probability forget or find confusing. However, the treatment of essential subjects is complete and, when taken in connection with the exercises, provides a working knowledge of foundry fundamentals.

There are three divisions: Fundamental Principles; Exercises and Problems; and Melting and Mixing Metals. Each division is concluded by a group of questions. The book contains also several tables of practical use to the foundryman, a bibliography, and a glossary of foundry terms.

Mechanics of Machinery. Mechanism. By Robert C. H. Heck, Professor of Mechanical Engineering in Rutgers College. Cloth binding, 749 illustrations and charts, 507 pages, 6x9 in. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price $5.

The first characteristic of this book which appeals to the reader is its completeness. It is written for the student and in text book style, but the addition of suitable explanations, illustrations, diagrams and sample problems tends to make it a very valuable treatise on the subject. It is an important addition to engineering literature and an accurate portrayal of the art of the machine designer and builder, not abstract or hazy in language or development, but practical and concise.

This first book, predominantly on Mechanism, is to be followed by a second volume dealing with Kinematics and Dynamics of Machines, since the whole field of motions and forces in machines is too big to be covered in one volume.

The material has been arranged and divided according to the kind of problems presented, rather than by relating it to different kinds of machines. In general, two methods of presenting the material have been used; first, by the use of a number of typical examples; second, by taking a simple principle or purpose and showing a large number of ways in which it is applied or realized.

Based upon kinematical considerations, the main division of the book is into machinery for uniform motion, for intermittent motion, and for cyclical or reciprocating motion. The first chapter is largely given over to descriptions of elementary machine elements of various forms and definitions of the important kinematic ideas.

Machinery for uniform motion is taken up by means of belt and rope gearing and various gear trains. Intermittent motion mechanisms include ratchets and escapements, clutches and reverse and stop mechanisms. The examples of the various devices are exceptionally numerous and the descriptions are excellent.

The section devoted to gear trains for speed variation deserves especial commendation for much of this material has not previously received adequate presentation in elementary and systematic form. This applies particularly to the various forms of the geometric-series gear train as used in machine tool drives, and the quick-change screw-cutting and feed trains.

Cyclic and differential trains are treated in the fifth chapter and are followed by a presentation of linkage mechanisms and movements. The diagrams in this section are numerous and assist greatly to a clear understanding of the various valve movements and other slide actions. The method for finding velocities by means of instant centers is clearly explained.

The remainder of the book is devoted to the important matter of gear teeth and covers the items of form, action and production. Of particular note is the discussion of the flexible involute system and the presentation of the hobbing method for helical teeth.

Cost Control for Foundries. By F. C. Everitr and Johnson Heywood. Edited by William R. Basset. Cloth boards, 225 6x9-in. pages. 91 facsimile forms. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York. Price $3.

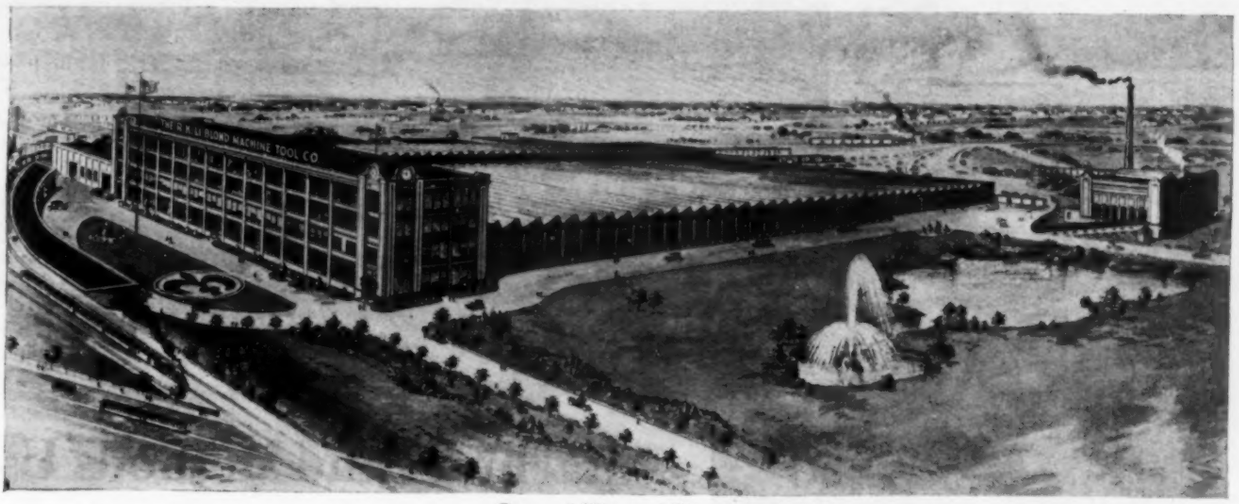
Probably no business uses more guesswork in attempting to determine costs of production than does the average iron foundry. Castings are sold by the pound and, as the price is generally set by competition, it behooves every foundryman to know accurately what his costs are, so that he may take only that class of work upon which he can make a profit.

This book deals with the fundamentals of cost finding and the authors have wisely made the systems advocated so elastic that they can be adapted to both large and small foundries.

Each step in cost keeping is so thoroughly explained that no prospective user of any of the systems set forth in the book, need have any fear of not being able to master the subject. The forms are plain and the terms used are shop terms, so that any man with brains enough to run a foundry should have no difficulty in following the idea of the authors.

Condensed Catalogues of Mechanical Equipment 1923-24. 678 pages 9x12 in. Published by the American Society of Mechanical Engineers 29 West 39th Street, New York City. Price $5.00.

This is the 13th annual volume and is the most complete yet issued. There are over 2,000 illustrations in the 471 pages of catalog data carried by 393 firms. The Mechanical Equipment Directory now contains over 30,000 separate listings. The book is printed on thin paper and bound in flexible covers so that it is very convenient to handle in using as a reference of mechanical equipment.



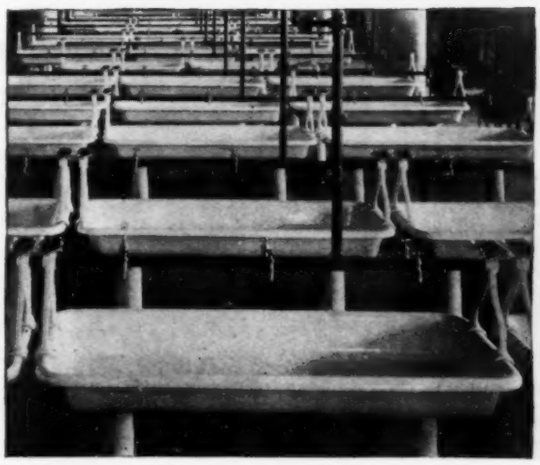
General View of Plant

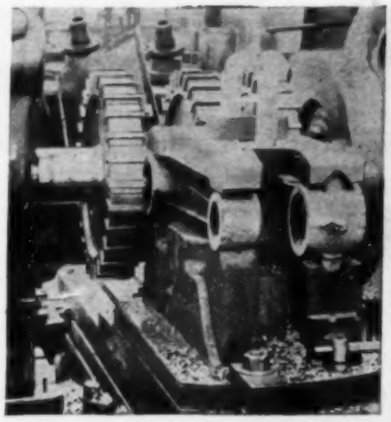
Where Machine Tools Are Made

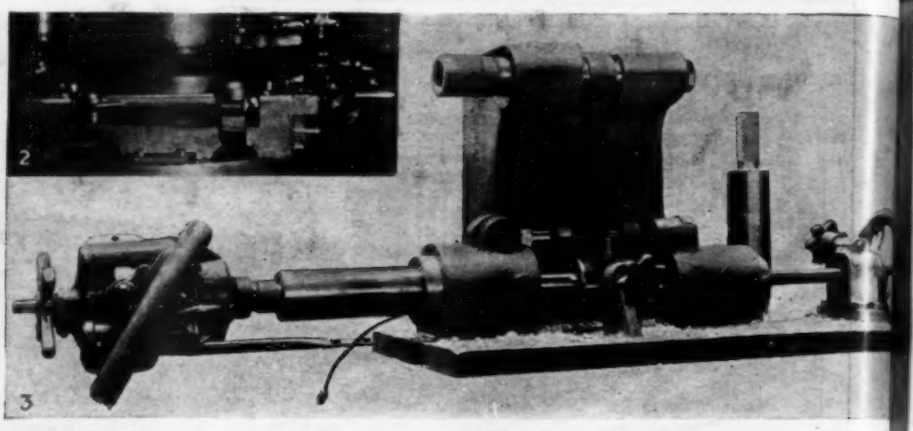
The R. K. LeBlond Machine Tool Company

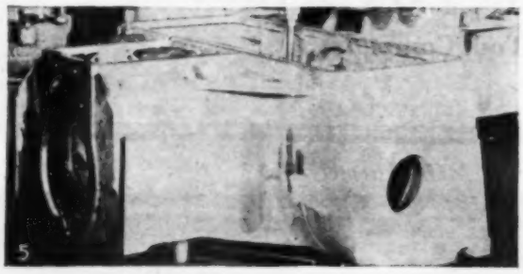
Founded 1887

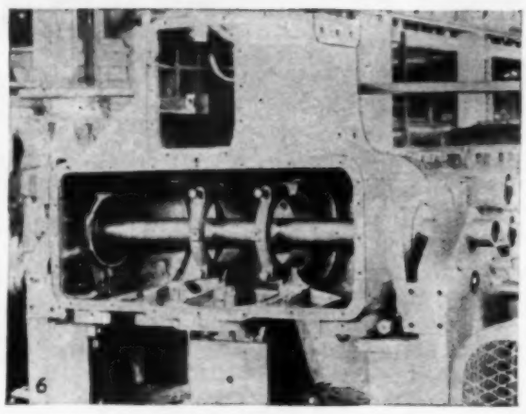
Views of Drafting Room, Wash Room and Main Assembly Bay











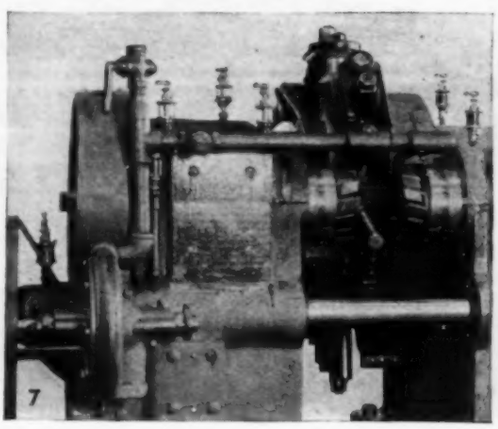
Machines and Methods Used

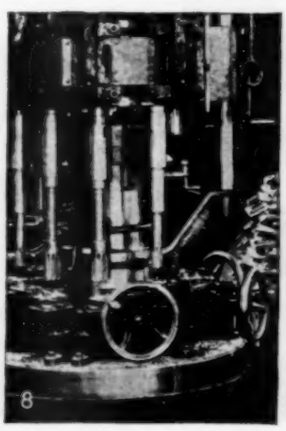
THE use of the large tractor is not common in the east and one is apt to be surprised at the number under construction in such plants as that of the C. L. Best Tractor Co., San Leandro, Calif. This company has not only studied production methods carefully but has designed and built a number of special machines for handling some of its work at low costs. Special fixtures are also largely used, one being shown in Fig. 1. This machine mills the ends of two connecting rods with three cutters. Fig. 2 shows a fixture with a quick-acting geared clamp for holding the rods while being drilled at each end under a multiple spindle machine. The final boring of the large end bearing is done in the fixture shown in Fig. 3, a Little David air drill supplying the power required. Drive shaft cases are milled with large cutters as in Fig. 4, drilled as in Fig. 5 and the bearing seats bored as in Fig. 6.

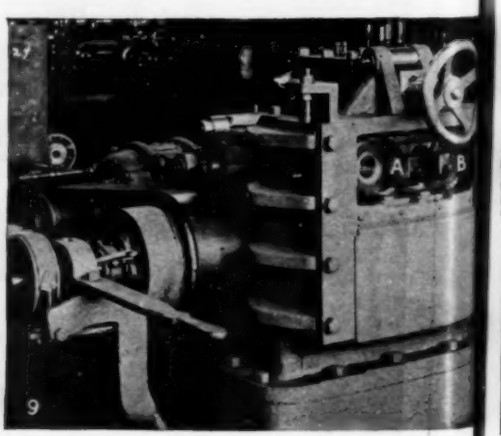
The track links are largely handled in special machines, Fig. 7 being a double head continuous milling machine, Fig. 8 a vertical, station type machine for drilling and reaming the pin holes, and Fig. 9 a special shaper for machining the insides of the links. The shaper ram carries the two cutter bars *A* and *B*.

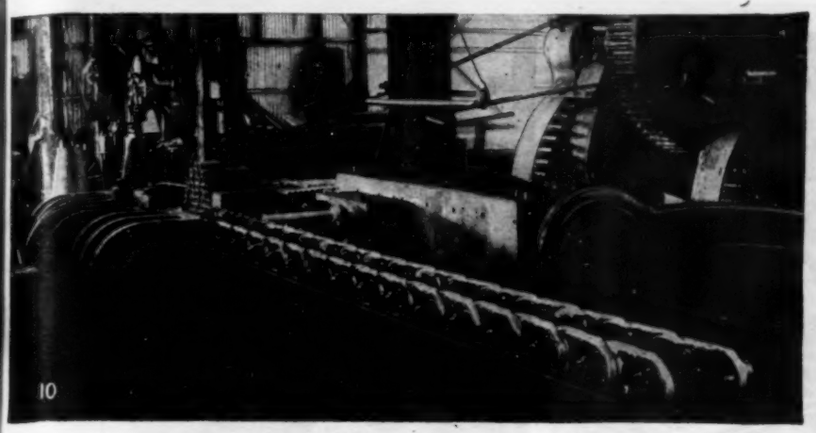
The links are assembled into tracks on the large bulldozer shown in Fig. 10. The thimbles, or distance pieces, are shown piled up beyond the plunger, or ram, which forces the pins through the links and the thimbles. The pins are threaded and have castle nuts and cotters in the end.

More continuous milling is shown in Fig. 11, this being a cylinder head job. Three fixtures are mounted on the revolving table on a special milling machine equipped with two vertical spindles, although only one spindle is being used in milling the cylinder heads, as can be seen by referring to the illustration.









In Building Large Tractors

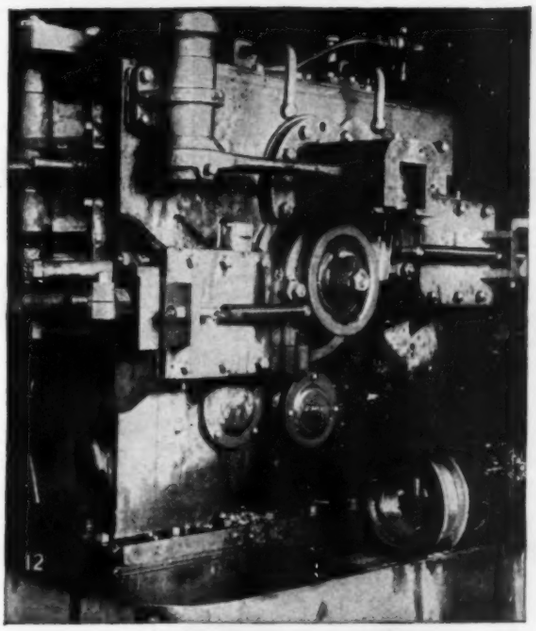
The cylinder heads lie inside the frame of the fixture and are located by the screws at the ends and sides.

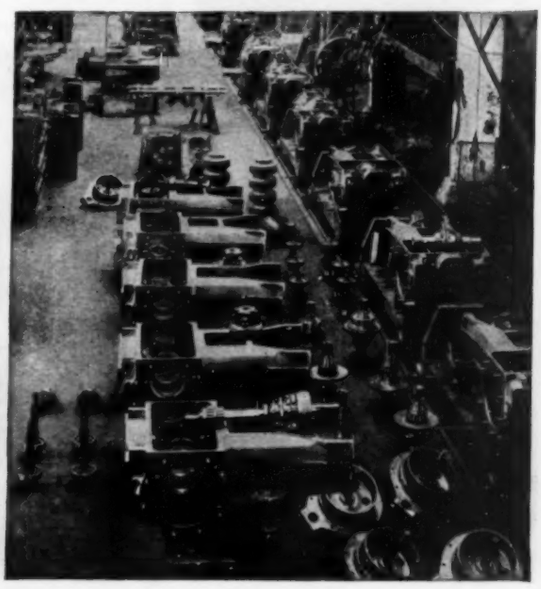
Perhaps the most interesting special machine is shown in Fig. 12. This is for turning the treads of the wheels which carry the track. A finished wheel is shown in front of the machine. The wheels are forged steel and are bored before coming to this machine. They are held on a mandrel having expanding jaws with serrated teeth. The jaws are tightened by the drawing in of a taper plug with the nut shown. The heavy cut taken makes it necessary to grip the wheel very firmly to prevent slipping.

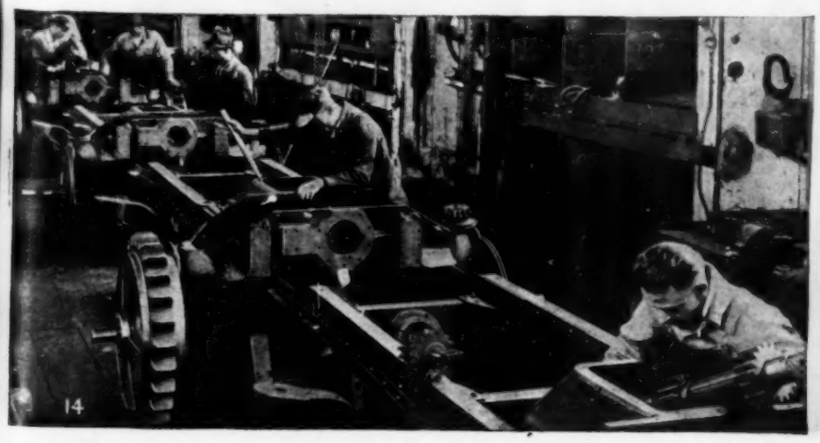
With the wheel firmly in place the machine is started and the tool carriages begin feeding in from each side, taking a heavy forming cut the full shape of the wheel tread. The machine is semi-automatic and releases the feed after the proper depth has been reached. The construction of the machine is very rigid as can be seen. The time for turning a wheel is about 4 min. during which time 19 lb. of metal is removed.

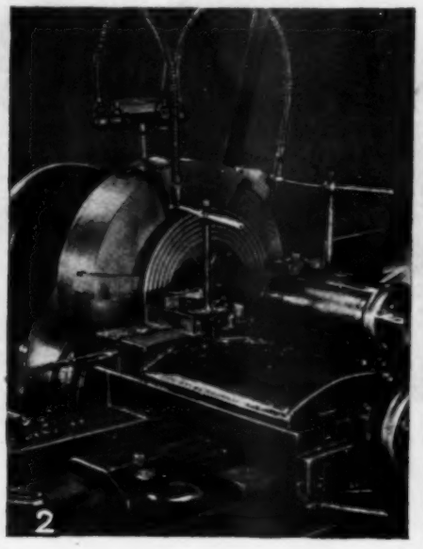
Figs. 13 and 14 show parts of the assembly line. The first gives a good idea of the number of tractors going through the plant and also shows the way in which trucks are used to secure continuous or progressive assembly. The tractor grows as it passes down the line, the parts shown standing beside the track being added as the trucks move down the long line of track. At the left are frame castings and parts ready to be placed on trucks and join the procession toward the finishing end.

Fig. 14 shows a close view of another type of truck, this having a frame built up of structural steel. A large sprocket wheel for driving the track is shown at the left. An idea of the size of the transmission gears can be had at the extreme right.



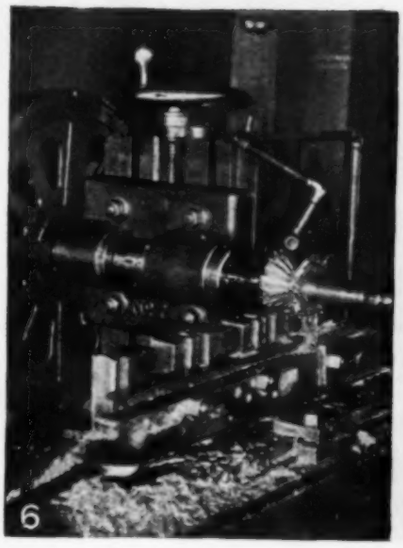


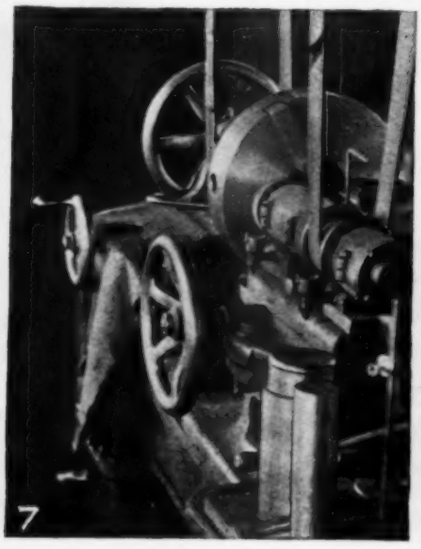


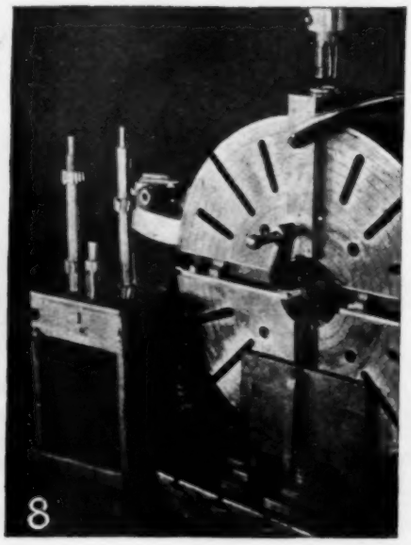


Some Operations on Horton Chucks

Fig. 1—Turning chuck bodies
Fig. 2—Cutting scroll plate
Fig. 3—Serrating jaws
Fig. 4—Threading jaw screws
Fig. 5—Cutting back of scroll plate
Fig. 6—Milling ends of jaws
Fig. 7—Grinding insides of jaws
Fig. 8—Reaming screw bearings







Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

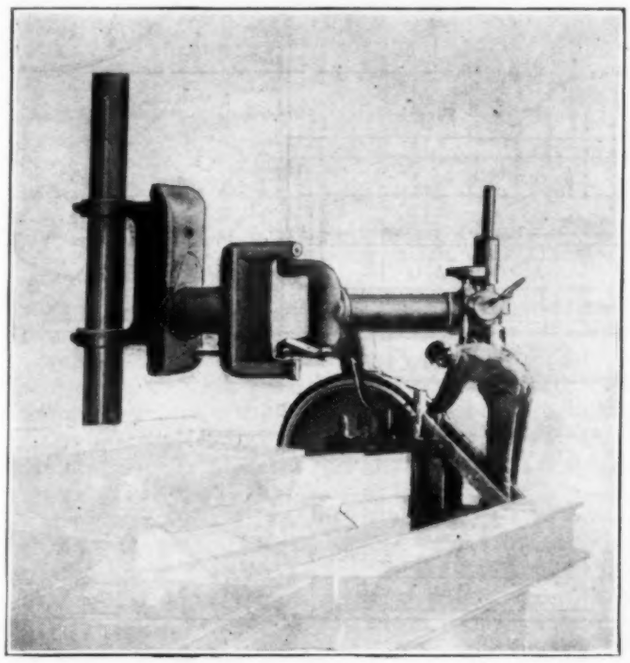
A Large "Elbow" Radial Drill

BY HERBERT CRAWFORD

Here is a type of radial drill which is occasionally found in small sizes, but I have never seen one of anywhere near the dimensions of the one built by the Llewellyn Iron Works, Los Angeles, Calif., for its own use.

The arms are supported by a column made of two pipes, one inside the other. The outer pipe is turned to 15 in. in diameter and reinforced by a 10-in. pipe. Both pipes are 20 ft. long but are sunk 8 ft. in a concrete foundation, leaving 12 ft. above the floor.

The main support is bored to a sliding fit on the



A VERY LARGE "ELBOW" DRILL

column and has clamping bolts so that it can be locked at any desired height for various work. When necessary to move the support on the column, either to raise or lower, the overhead crane is used, as the weight of the arms runs into tons.

The drilling arms are joined both at the "elbow" and on the column support so that the machine is very flexible when it comes to reaching different parts of the work. The arms have a total length of 10 ft. with the swing joint at the center. All joints have ball bearings so that the drilling head is easily moved into any desired position by one man. The maximum radius of operation is 10 ft. and the drill can be moved through an arc of 270 degrees.

The drilling head at the outer end of the arm has a vertical movement of 12 in. It carries a Van Dorn electric drill with a motor rated at 2 hp. and running 600 r.p.m. The feed is 1 in. in depth for each 183 revolutions of the drill. This machine is used exclusively for drilling boiler and similar plates, with holes up to 1⅛ in. in diameter. The plates are usually stacked to give a total thickness of approximately 6 in. A switch controls the starting and stopping of the motor and the drilling spindle.

Automobile Piston Clearances—Discussion

BY DOUGLAS P. MUIRHEAD
Glasgow, Scotland

On page 65 of the *American Machinist* I notice that O. M. Burkhardt does not agree with the particulars given in my chart for piston clearances appearing on p. 344, Vol. 58, as he considers the clearance above the top ring to be too small. This is a subject on which no two designers seem to agree, as I have found from the large number of engines which I have measured at different times. In order to show that this is the case, I submit the accompanying table giving

TABLE SHOWING CLEARANCES ABOVE TOP RING ON PISTONS OF EUROPEAN AIRPLANE ENGINES

Cylinder Bore, Inches	Piston Clearance, Inches	Piston Material	Cooling	Clearance per In. of Diameter, Inches
4.500	0.022	Cast iron	Water	0.0048
4.724	0.020	Cast iron	Water	0.0042
3.937	0.027	Cast iron	Air	0.0060
5.118	0.031	Steel	Water	0.0060
5.590	0.031	Steel	Water	0.0055
5.708	0.040	Aluminum	Water	0.0070
4.500	0.020	Aluminum	Water	0.0044
4.724	0.031	Aluminum	Water	0.0060

particulars of piston clearances above the top ring for a few of the most successful European airplane engines.

It will be noted that practically none of the makers agree with each other as to what should be the correct amount of clearance for the different piston material and methods of cooling. It will be found that there is the same difference of opinion regarding clearances for automobile engines, and it is therefore difficult to employ any definite means of calculating the clearance when so many variables exist. I therefore think that experimental evidence is much more valuable.

I notice that Mr. Burkhardt states that the piston-head temperature has been found to be 800 deg. F. Here again a difference crops up, as Professor Hopkinson in this country found that the piston-head temperature in an ordinary four-cylinder automobile engine reached 932 deg. Fahrenheit.

I therefore maintain that the figures given in the chart are satisfactory for all practical purposes, and for probably 80 to 90 per cent of the engines on the market. It does not necessarily follow that the clearances given will be suitable for special high-speed, high-compression engines.

Appliances for Bending Steel Panels for Railway Cars

BY A. EYLES
Manchester, England

The accompanying illustrations show appliances that I have recently designed for the purpose of bending steel-sheets and plates, embodying combinations of curves which could not be secured satisfactorily upon standard bending machines. The plates were to be used as panels along the sides of steel railroad-cars of various types.

Such panels were formerly made of wood from $\frac{3}{8}$ to $\frac{1}{4}$ in. in thickness, bent to the desired shape. Wood panels, however, have the disadvantage of shrinking, after a time, and causing the paint to crack. Also, in the case of accident, wood panels might be burned, or else so badly split that they could not be repaired, whereas in most cases a skillful worker can flatten out a dented or damaged steel panel.

Improvisations and appliances for manipulating sheet and plate metal work were an important feature in our shop, mainly for the reason that our orders were usually for a limited number of pieces, and it was often the case that effective results could not be obtained by the use of standard bending and forming machines. It was therefore necessary to devise such appliances in order as would effect results uniformly and expeditiously.

Referring to Fig. 1, *A* and *B* show the side and end elevations respectively of a cast-iron bending appliance, designed to form the corresponding curves of the panel shown in the same figure. This panel was made of Siemens steel, 0.098 in. thick.

To obtain the desired shape, one end of the steel plate is first put through the standard bending rolls and curved to a templet as at *C*. It is then taken out, the opposite end put in the groove *D* of the bending appliance and the metal bent over the form as far as possible, where it is clamped at *E* on both sides of the form. The curved part is then suitably worked over the form to the desired contour.

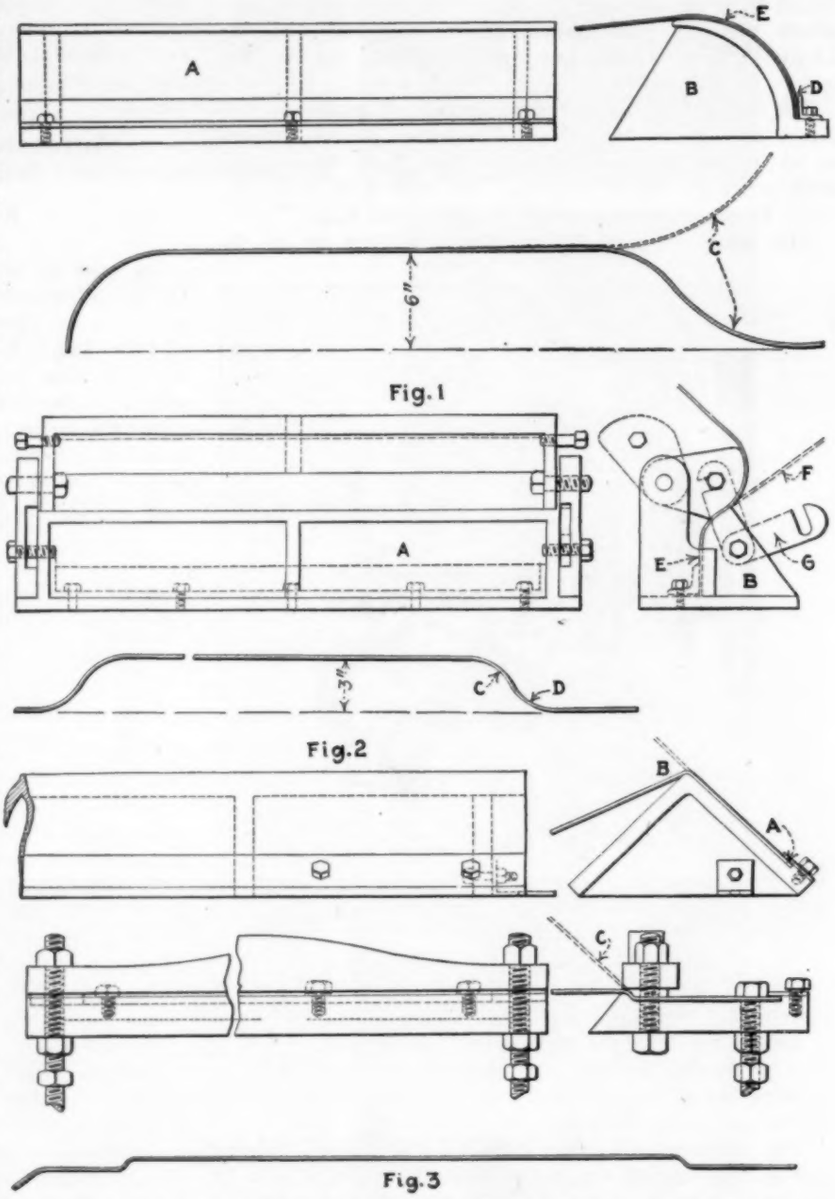
Orders for this type of panel are usually obtained in lots of 100 and it is needless to say that each curve is completed on the whole lot before proceeding with the next operation. Countersunk holes for wood screws are made in the plate before the bending operations are started.

In Fig. 2, *A* and *B* show the side and end elevations of a cast-iron bending appliance that proved extremely useful in forming the double curvatures *C* and *D* on a number of panels of 0.0625 in. Siemens steel. To bend the panel to shape, one end of the plate is put in the groove *E* and worked over as at *F*. The top portion of the appliance is then brought over and firmly secured by the fastener *G*, when the metal is worked over the form to complete the double curvature. It is then taken out and the opposite end treated in a similar manner.

Fig. 3 shows the side and end elevations of bending appliances employed to form another panel in which the radius of curvature was very short, necessitating the use of two appliances to obtain exactness of contour.

One end of the work is first put in the groove as at *A* and the plate worked over as at *B*. It is then taken out and placed on the form as at *C*, where the top portion of the appliance is screwed down to hold the metal while the remaining portion of the curve is being formed. It is then taken out and the other end bent in the same way.

Generally the surface close to the bend requires flattening and this is best done while the plate is still in the bending appliance. Care should be exercised that the hammer blows are delivered evenly and uniformly,



FIGS. 1, 2 AND 3—STEEL PANELS FOR RAILROAD CARS AND THE BENDING APPLIANCES FOR PRODUCING THEM.

as the result of irregular hammering will show up badly when the panels are painted and varnished. To prevent marking the metal, a block of wood of suitable size and shape should be used.

A Tapered Bearing Problem Solved by Right Triangles

BY KARL G. KECK

A machine-tool spindle *S* in Fig. 1, assembled in its tapered barrel *W* mounted in housing *R*, revolved at a high rate of speed, and the driving belt running over pulley *K* repeatedly climbed up onto flange *F* of the pulley. As the belt which was being used happened to be of a woven material, the edges of it soon became frayed, causing the belt to rapidly wear narrower and narrower until the breaking point was reached. The

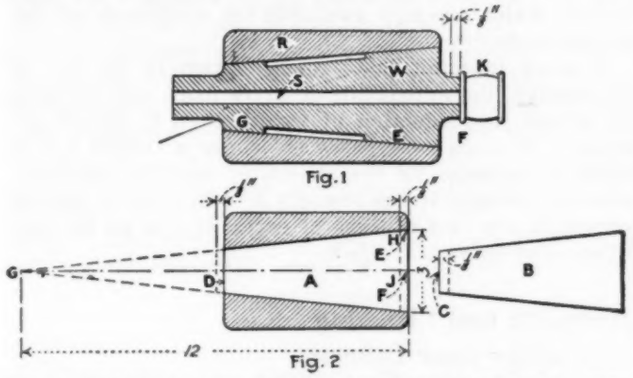


FIG. 1—SPINDLE ASSEMBLY REQUIRING ALTERING. FIG. 2—FINDING THE DIAMETER OF BARREL REQUIRED

extremely short life of the belts used on this drive soon attracted the attention of the superintendent of the shop in which the spindle was running; and an investigation followed to increase the life of the belts, which were expensive, and to eliminate also the frequent changing of the belt itself, which consumed quite a bit of time.

It seemed after careful consideration that, if flange *F* were placed nearer the housing *R*, the trouble would be eliminated and the fraying of the edges of the woven belts would stop. Therefore the superintendent instructed his men either to bore larger the hole in the housing *R*, or to turn down the tapered diameters *G* and *E* of the spindle barrel *W*, so as to permit of inserting the spindle and barrel assembly further into the spindle housing. The men decided to turn down the barrel diameters enough to allow moving the spindle and barrel assembly $\frac{1}{8}$ in. deeper in the housing than had been the practice—and here a snag was encountered.

No one seemed to know just how much the tapered spindle-barrel diameters should be turned down so as to allow the barrel to enter $\frac{1}{8}$ in. further than before. The engineering department and shop mathematics books were consulted, and by the use of trigonometry and higher mathematics the problem was solved.

The actual calculations involved in the solutions that were offered did not, however, appeal to the men who had been given the job of turning down the diameters of the spindle barrel, so these men persisted in finding a more simple solution, and one whose calculations they themselves could understand and learn for future use. Finally, the following plan was hit upon, and it proved the simplest and quickest of all those offered.

Hole *A* in Fig. 2 which represents the bore through the housing for the spindle barrel, was found to be tapered 3 in. to the linear foot, included angle. Normally *B*, which represents the spindle barrel, fitted into hole *A* so that end *C* came flush with the housing at the small diameter *D* of the hole.

Completing the figure for one-half of the bore, the similar right-angle triangles *GEF* and *GHJ* are obtained. In solutions of similar triangles the corresponding sides are proportional. Thus

$$GF : EF = GJ : JH$$

$$\text{Or, } 12 : 1.5 = 11.875 : JH$$

$$JH = \frac{11.875 \times 1.5}{12} = 1.4843 \text{ in.}$$

$1.5 - 1.4843 = 0.0157$ in. to be removed from one side.

$2 \times 0.0157 = 0.0314$ in. stock to be removed from the maximum diameter.

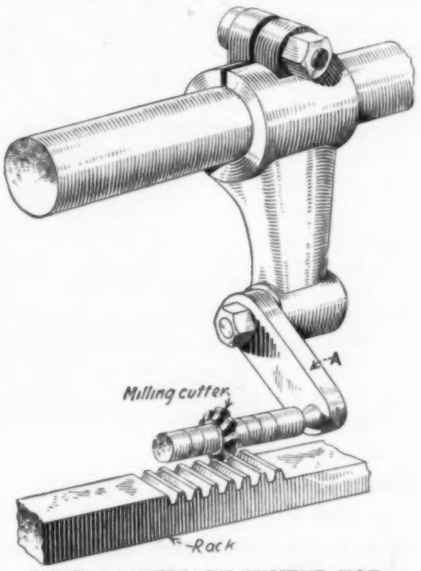
Thus the barrel will protrude 0.125 in. at the left and the flange *F* in Fig. 1 will be moved the same amount toward the housing *R* when the barrel is turned to the same taper as before, but with a maximum diameter 0.0314 in. smaller.

The real reason for the value of this method of figuring the result lies in the fact that the calculations are based on the taper of the bearing and are quite simple. It is thus not necessary to make a separate calculation for each size of bearing. No matter what the diameter be, it is merely necessary to remove the amount just calculated, in order to bring the barrel $\frac{1}{8}$ in. further into the housing.

Auxiliary Milling-Machine Center

BY R. R. JOSEPH

It occasionally happens that the lower end of the outer support on the overarm of a milling machine is too large to allow the table to be brought up so that small cutters can be used. The cutting of a piece of rack is an example in point. By using a small strap or auxiliary arm, as shown at *A*, it is possible to get very close to the work. This strap *A* is simply a substantial piece of steel with a steel center in the end for supporting the outer end of the cutter arbor. The diameter of the center in the end of the strap should be no larger than the diameter of the spacing collars on the arbor and the strap should not project beyond the large diameter of the center. This device will be found very useful in many cases, and can be made up in advance, so as to be available at any time.



SMALL AUXILIARY CENTER FOR OVERARM ON MILLING MACHINES

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

November 1, 1923

There Are Real Dividends In Modern Equipment

A CERTAIN shop manager took a machine tool salesman into his plant not so long ago and showed him one of the machines he represented that had been running for 25 years and was still on the job. The manager was trying to please the salesman, of whose machines he was genuinely proud. Imagine his consternation when the salesman told him that he ought to be ashamed to let anybody know that he had kept a machine on production work for 25 years.

The sequel to this story is not yet. But that salesman has the figures to show that the old machine is losing money for the manager every day and it is safe to predict a replacement soon.

The salesman is going to show the amount of total added investment in buying the new machine, which will include the cost of the machine with standard tools plus the cost of special tools, minus the second-hand cash value of the discarded machine. He will then show the saving per year due to the new machine, figured from the time saved per piece, the production per day, and the number of working days. From the saving per year he will deduct for the depreciation of the machine and standard tools and will write off all of the special tools, in that way arriving at his figures for net saving. Finally he will divide the net saving by the cost of the additional investment to obtain the earning power in per cent. The manager of the plant will quickly awake to the perils of his 25-year-old machine, if the figures are anything like some that the salesman has already produced, which run from 50 to 145 per cent.

It was pointed out on this page some weeks ago that "the best way to show faith in the stability of your own business and in your management is to invest in the best machine equipment that can be had to handle your work." Investments that will return anything like 50 to 145 per cent are indeed scarce. The men who sell production tools ought to be able to put it all over the bond salesmen with their very ordinary 6 to 8 per cent.

Automobiles and Prosperity Go Together

TRANSPORTATION has always been a vital factor in civilization. Without any motive power all business would be confined to an area limited by a man's walking ability. And the transportation of merchandise would be almost out of the question.

Consider the transport facilities afforded by the motor car in both the passenger automobile and motor truck. It is little wonder that the desire for individual transportation facilities has become so widespread. In spite of predictions of dire disaster due to the extravagance of owning motors, the results seem to reverse the case. For we find that localities having the most automobiles are the most prosperous.

An analysis of the situation lends credence to the belief that the states with the greatest wealth have the most automobiles because the use of motor transport helps materially in creating the wealth with which they are purchased. The development of outlying districts is greatly aided by motor transportation and the rapid movement of both passengers and goods in turn increases the wealth of the community.

Because of the automobile all manufacturing industries have learned much in the way of large scale production, of maintaining accuracy at ever lowering costs. Machine tools have been developed for the building of motors which are now available for machinery of different kinds.

Bearing in mind that transportation is the key of civilization, the automobile deserves more consideration as an aid in production of wealth than it usually receives. It is in most cases no longer a luxury but as much a necessity as the telegraph and the telephone. And the benefits it has brought to other businesses far outweigh any just charges of extravagance on the part of some of those who use it.

Research and "Digging" in the Gear Industry

THERE was a sound, constructive suggestion made by E. W. Miller in a paper before the American Gear Manufacturers Association last week. He wants the association to do some research work in locating new uses for gears. Digging up opportunities for new applications isn't generally dignified by the term "research," but it may well be; at any rate the digging process will open up the way for a great deal of research that will have a splendid throw-back on the industry.

Up to the present the members of the association have been directing their energies to finding new methods of making gears and to learning how to make them accurately, both necessary to prevent wasteful effort in finding more uses for gears. But development of accuracy and process is now so far along that a part of the energies of the association may be directed to finding new uses, in other words more business. Whether by research engineers employed by the association, or by industrial firms, the association would decide. Nor would the work be entirely selfish. As was pointed out, it should in no case be the intention or the fact to recommend the use of gears where better results could be obtained without them.

This matter of research gives rise to another line of thought. What wouldn't thorough "digging" do to keep away dull times? Some of the gear manufacturers know that they can keep their output on about a level line if they dig hard enough to get orders. As they put it, the business is there if it is only hunted up. Following out Mr. Miller's suggestion would be going after it harder than ever.

Shop Equipment News

The M.-G. Production Unit

The "M-G. production unit" is the name applied to a recently developed machine tool by its makers, the Meldrum-Gabrielson Corp., West Fayette and Niagara Sts., Syracuse, N. Y. The machine is adapted for the production of large quantities of parts such as used in the manufacture of automobiles. It can be applied to drilling, reaming, tapping, boring, turning, milling and other operations.

By referring to the accompanying illustration, it will be noted that there are two columns independent of each other; the only connection between the two machines are the base and tie-bar. The arrangement provides a very compact machine, making it easily possible for the operator to serve both spindles without moving from his position. The center distance between the spindles is 33 inches.

The machine illustrated is the No. 2 size, and is capable of driving a 2-in. drill through nickel steel with a feed of 0.015 in. per revolution. The mechanism in each column is driven by means of a single pulley mounted between the columns. These pulleys are 4½x16 in. in size and run at 450 r.p.m. When desired, individual motor drive can be employed, with a 5-hp. motor mounted on the back of each column.

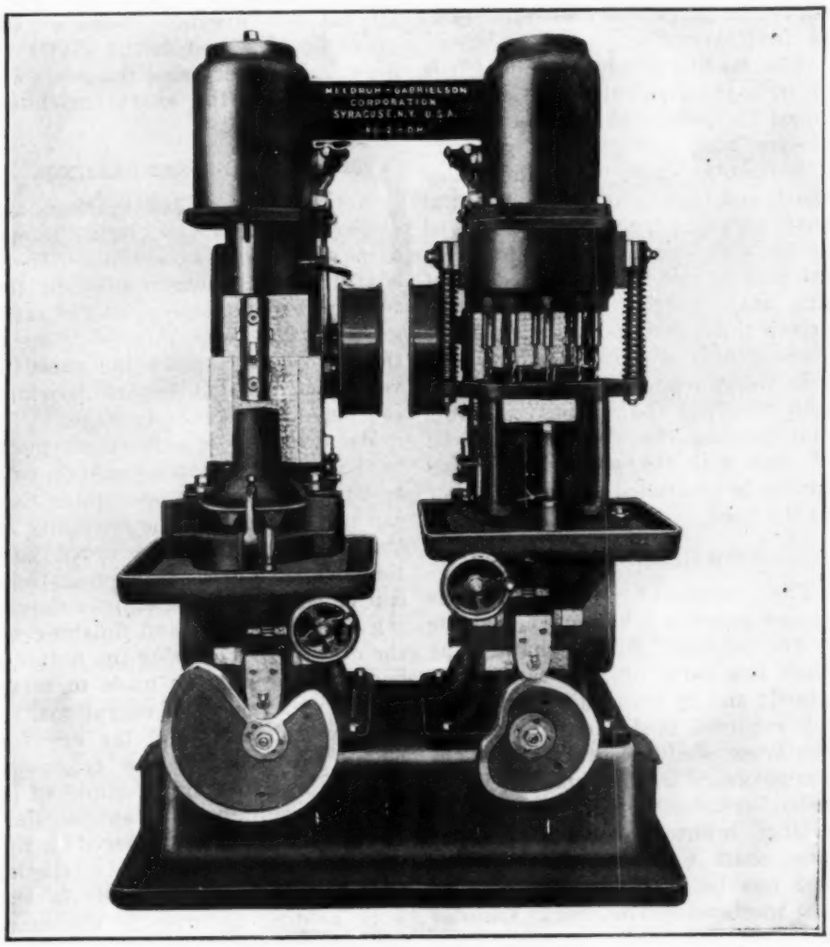
Before going further, it would be well to note construction of the column. It is of box form and made in one piece from the base to the spindle head. The absence of a joint at the bend provides rigidity. The average section of the column is 9x12 in., and the throat depth is 12 in. The full height of the machine is 6 feet.

The work is held on the table by a special clamping fixture best adapted to it. The table, in turn, is mounted on a slide secured to the front of the column and provided with a vertical feed. The motion of the slide is obtained by means of large cams that can be seen at the front of the machine near the floor. These cams can be provided to give a maximum drop of 10 in. In addition the table can by means of the handwheels be adjusted 13½ in. on the slide to suit the height of the work.

The cams are employed instead of screws for the feeding motion, as by means of them the speed of the motion can be varied throughout the cycle to suit the work. It is thus necessary for the operator only to start the machine; the rest of the cycle is carried on automatically until completed, at which point the machine stops.

The mechanism employed for driving and feeding is completely enclosed in the column, so that dust cannot reach it. Inside each driving pulley is an expanding ring clutch that is operated by means of a lever on the side of the head. From the pulley shaft another horizontal shaft above it is driven by means of gears. The gears on the pulley shaft slide on splines, and are arranged so that two speeds can be obtained, with a ratio between them of 1:1.2. Sliding the gears is done by a lever on the outside of the column.

This second gear shaft is provided at its outer end with a removable change gear that meshes with a similar gear on a shaft placed above. Access to the change gears can be obtained by removing the cover plate on the side of the column. By interchanging the removable gears, together with the two quick changes of gears, four spindle speeds are obtainable. By selecting change gears to suit the work, any speed necessary can be had.



M.G. PRODUCTION UNIT

From the upper change gear shaft the drive is through bevel gearing to a shaft placed at an angle and passing through the bend of the column. The upper end of the shaft connects through bevel gearing with the upper end of the spindle. The spindle is mounted in three ball bearings, two double-row radial thrust bearings and one single-row, all being ample in size to carry any load within the capacity of the machine.

The face of the spindle is flush with the head. Extensions can be provided to suit the particular type of machining operation, and they are mounted on the face of the spindle by a tongue and groove joint. It should be noted that the spindle has no feeding motion.

The feeding mechanism, which is entirely independent of the drive, is below the pulley shaft. The feeding motion goes first through gears to a horizontal shaft below the pulley shaft, and then to another horizontal shaft carrying both a bevel gear and at its outer end a pulley to drive the pumps. A frame pivoted about this shaft carries a vertical shaft driven through bevel gears. At the lower end is a worm meshing with a bronze wormwheel. To start and stop the feed the frame is swung, thus putting the worm in and out of mesh with the wormwheel. This motion is controlled by a small lever on the head.

Feed Gearing and Cam

The wormgear shaft carries change gears in a box on the outside of the column. By alternating the gears two rates of feed can be obtained; and by using different gears any required feed can be obtained. The lower shaft of the pair for the change gears carries another worm inside the column. This worm drives a large bronze wormwheel on the same shaft which carries the cam that can be seen on the front of the machine. The cam follower mounted on the slide can also be observed, so that it should be clear as to how the vertical feed is obtained.

A pump mounted on each column forces the coolant to the work and floods it over the cutting tools. Provision is made on the table to care for the coolant, which is returned from the table to the reservoir.

A feature of the machine that deserves particular attention is the arangement for oiling the bearings and gears. Each column has its own oil pump mounted on the back of the column and taking oil from a 7-gal. reservoir in the bottom of the column. The oil is pumped to the top of the head and flows over the spindle bearings. From here it runs down over all the gears and bearings in the driving and feeding mechanisms. Deflectors are placed where necessary so as to guide the oil and cause it to cascade over all the frictional surfaces.

One of the main characteristics of the machine is its rigidity and strength, suiting it for continuous operation under heavy cuts. The weight of 6,500 lb. is sufficient to prevent excessive vibration. All the gears and the shafts are made of chrome-nickel steel and are heat-treated and ground. None of the gears are fastened to the shafts by keys, but in every case the gears are broached and the shafts machined with six splines.

Ball and Bronze Bearings

New Departure ball bearings are employed for every shaft in the machine with three exceptions. These shafts are the bottom ones in the feed mechanism, and carry the worm gearing that was previously mentioned. At this point the speed is very low, so that bronze bearings can be employed to advantage.

We can now give more attention to the method of mounting the work, and to the different operations that can be performed. The flexibility of the machine should be noted particularly, as a great many operations can be done. On one spindle roughing might be done, and finishing on the other. By changing the fixtures, one machine may be made to serve for a great variety of operations.

A typical part, and the one for which the machine was originally developed, is the carrier employed in the differentials of automobiles. There are five units employed on the work, each doing its own special operation. They differ only in the work holding fixtures, in the cams and in the tools fitted to the machines. In the illustration this carrier itself can be seen on the table at the left.

The work is held by means of an air chuck. A stabilizer or brace not shown steadies the top of the casting. The machine is equipped with a boring bar that is roughing the pinion bore for two diameters and facing the end. Operation 2, shown in the set-up at the right, consists in drilling twelve holes in the flange and four holes for the caps. The work is held in a swinging fixture, which enables its easy replacement. As the table rises, the work is clamped from above by the spring-pressure plate. On the head of the machine is mounted a special drilling head fitted with sixteen spindles.

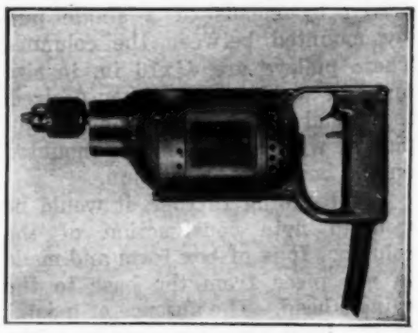
The other four units, required to finish the part, perform the operations of the rough and finish milling of the flange and the cap seats, tapping four ½-in. holes for the cap, spot facing the twelve bolt holes, roughing and finishing the cross-bore, and tapping the cross-bore.

The variety of the above operations, together with the fact that they are all done on the same machine or unit, using proper tools and cams, shows the versatility of the machine. The five units, run by three operators, have effected a considerable economy as compared with the methods formerly employed. The estimated time for completion of this part was 15 min., but the time has been further decreased in practice.

Black & Decker 5/16-In. Portable Electric Drill

A recent addition to the line of portable electric tools manufactured by the Black & Decker Mfg. Co., Baltimore, Md., consists of an electric drill with a capacity up to ⅝ in. in diameter in steel.

This tool is similar to the ¼-in.



BLACK & DECKER ⅜-IN. PORTABLE ELECTRIC DRILL

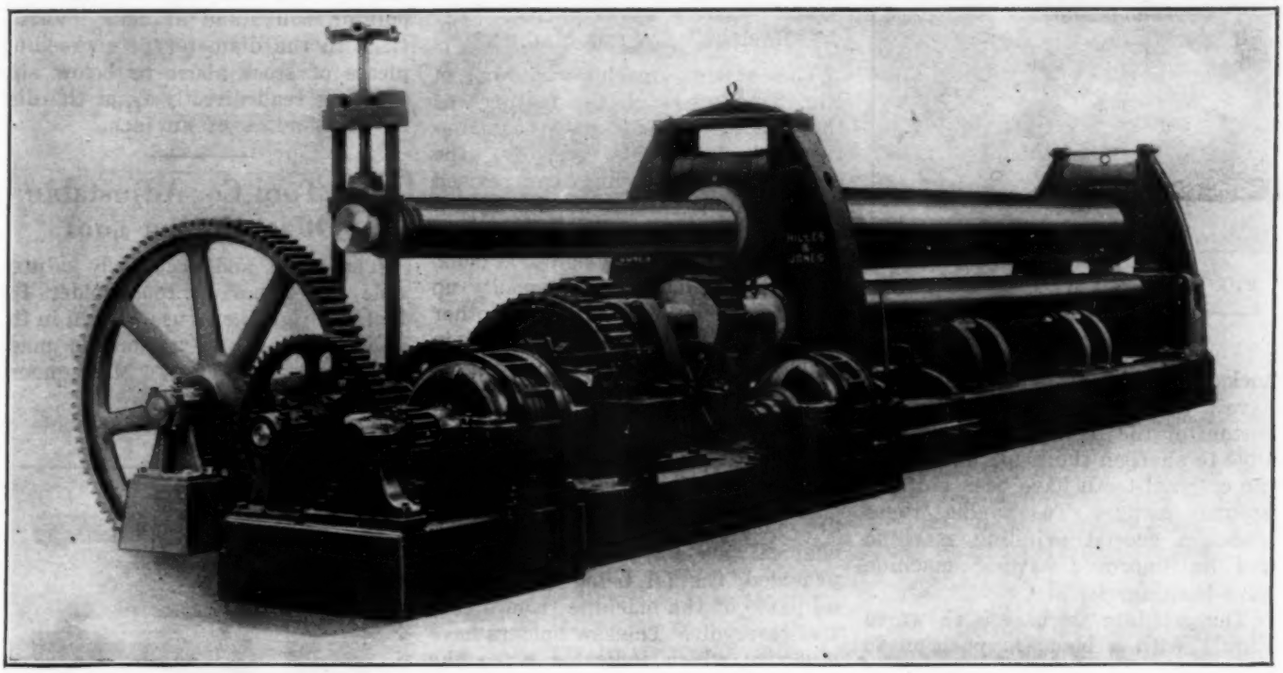
drill made by this company and previously described on page 742, Vol. 55, of the *American Machinist*, but has a more powerful motor and is proportionately heavier. It is equipped with the pistol grip and trigger switch found on other tools of this line.

The 3-jaw gear nut chuck is adapted for straight shank drills. The tool weighs 7 lb., and the no-load speed of the motor is 1,400 revolutions per minute.

Hilles & Jones No. 9 Bending Roll

An exceptionally large boiler plate bending roll has recently been completed by the Hilles & Jones works of the Consolidated Machine Tool Corp. of America, 17 East 42nd St., New York, N. Y. This machine is shown in the accompanying illustration and was built for the Heine Boiler Co., to handle plates up to 1⅛ in. thick and roll them to relatively small diameters. This machine has been designated No. 9, and is of the heavy-duty, hinged-housing type.

The distance between the housings is 26½ ft. so that plates up to 26 ft. long can be handled by the rolls. Two interchangeable upper rolls are provided, 30 and 36 in. in diam., respectively. The 36-in. upper roll is used for rolling the heaviest plate to comparatively large diameters, the smaller roll being provided to roll plates to diameters as small as 36 inches.



HILLES & JONES NO. 9 BENDING ROLL

Mounting for Lower Rolls

The lower rolls are each 22 in. in diameter and the roll bearings in the housings are bushed with bronze. All the rolls are made of open hearth forged steel, and the upper rolls have a solid forged extension which counterbalances the roll when the back housing is dropped down for the removal of plates rolled to full circles. The housings and all driving gears are steel castings, the housing bed plates and gearing bed plates being semi-steel castings with a box section.

The upper roll is supported from the roll necks which are fitted in trunnions having bearings bushed with bronze. The trunnions are carried in yokes, the back yoke being a steel casting while the front yoke, which supports the upper roll when counterbalanced, is a steel forging machined to shape. The raising and lowering of the roll is accomplished through a worm and worm wheel drive, which is so designed that both ends of the upper roll may be raised or lowered simultaneously, or one end held stationary while the other end is raised or lowered.

This arrangement for operating the upper roll is necessary in rolling plates to conical shapes, and is often found advantageous in ordinary boiler shop practice. The worms are machined cast bronze and run in enclosed bearings designed to provide for lubrication with either heavy oil or grease. The worm wheels meshing with the worms are made of cast steel and have teeth cut from the solid.

The driving pinions on the lower roll necks are steel castings shrouded to the pitch line. These pinions are both driven from a wide faced cast steel gear also shrouded to the pitch line, and this driving arrangement conveys power directly to both lower rolls. The machine is geared for two speeds; a slow speed for handling the heavier plates, and a high speed for handling lighter plates. The control of the speeds is by hand levers direct to positive clutches.

Roller Supports for Lower Rolls

Two substantial roller supports are provided for the lower rolls and each support carries four forged steel rollers finished to 7⅛ in. in diameter. The rollers are carried in closed end bearings, which design provides for lubrication of the rollers by means of large grease cups, and this arrangement not only insures lubrication but also keeps scale and dirt from clogging and stopping the action of the rollers.

All high-speed shafts have bearings bushed with bronze, and substantial outboard bearings are provided to carry the outer end of all driving shafts so that there are no overhanging gears. All these bearings are provided with oil cups for effective and ample lubrication.

The machine is operated by two motors, a motor of 125 hp. being used for driving the lower rolls, and a motor of 60 hp. for raising and lowering the upper roll. The large motor is located at the front end of the machine as shown in the illustration, the other being placed near the front roll housing. The weight of the machine is 415,000 pounds.

"Rapidor" Metal Sawing System

The "Rapidor" machines for metal sawing, manufactured by Edward G. Herbert, Ltd., Manchester, England, have recently been placed on the market by the Tinius Olsen Testing Machine Co., 500 North Twelfth St., Philadelphia, Pa.

The feature of this metal sawing system is an unusual design of

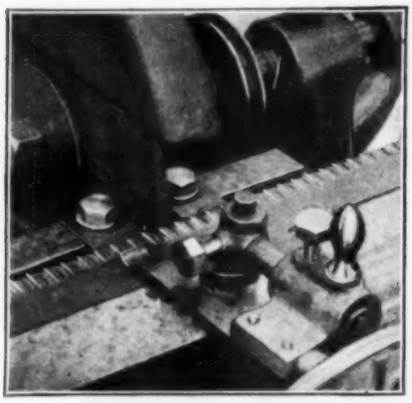


FIG. 1—"RAPIDOR" GRINDING MACHINE WITH BLADE IN POSITION

hacksaw blade in which the teeth have a set which extends below the bottom of the teeth, making it possible to sharpen the blade until after the original teeth have been entirely ground away. To handle these blades a special grinding machine and an improved sawing machine have been developed.

The grinding machine is shown in Fig. 1 with a blade in position to be ground and the special design of

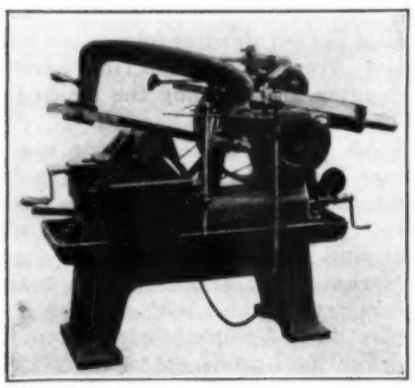


FIG. 2—"RAPIDOR" SAWING MACHINE

the blade is illustrated. The teeth are automatically ground to the correct shape, the blade being moved up to the wheel in contact with models of the correct tooth contour. The teeth are ground on both faces. A diamond truing device is provided for dressing the wheel to the correct angle. This machine, though designed especially for the "Rapidor" blade, will grind any hacksaw blade to considerable advantage, and the special blade may also be ground on other machines.

These blades are made of high speed steel containing 18 per cent tungsten and are hardened throughout. It is stated that they can be ground as many as 20 times, the cutting speed increasing after each grinding. It is claimed that the average time required per cut is halved by the use of this blade, and that the output per blade is increased more than seven times.

"Rapidor" Sawing Machine

The sawing machine shown in Fig. 2 possesses all the features of the "Rapid" sawing machine manufactured by this company, the detailed design having been revised in many particulars to take advantage of the speed and power of the special blades. The machine is made in two sizes, one with a capacity up to 6-in. rounds or squares, the other handling rounds up to 10 in. in diameter and other sections to 12x8 in. in size.

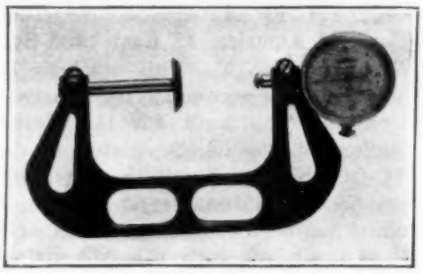
The sawing machine can be operated at a speed of 170 r.p.m. and applies a heavy pressure to the blade. The main shaft and crank pin are hardened and ground. A mechanical system of lubrication is provided, the oil being supplied to all parts of the machine from a central reservoir. The saw holders have a device which indicates when the saw is strained sufficiently, and intended to prevent breakage of saws through incorrect tension.

Federal Round Stock Gage

The Federal Products Corp., 15 Elbow St., Providence, R. I., has added to its line a gage, or comparator, for checking the diameter of round stock up to 4 inches. The tool consists of a skeleton yoke, an adjustable anvil and a standard Federal dial gage with reset dial and clamping screw.

The design of the yoke is such as to combine lightness with strength and at the same time provide a convenient grip for the operator's fingers. The anvil has a mushroom head with a flat surface of ample size to insure a proper bearing of the work upon it. The edge of the anvil is bevelled and the end of the measuring spindle rounded so that the gage may be pushed over the stock readily.

The gage is first set to a size block or trial piece by clamping the adjustable anvil in the required position



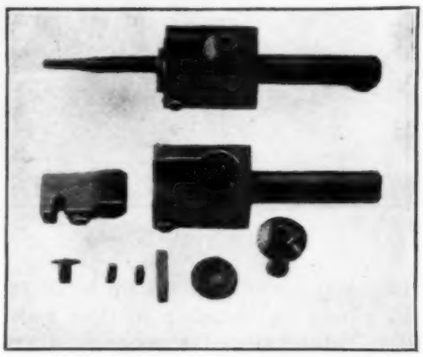
FEDERAL ROUND STOCK GAGE

and setting the dial so that the pointer will stand at zero. Variations in the diameter of succeeding pieces of stock above or below size are thus read directly from the dial in thousandths of an inch.

Art Tool Co. Adjustable Offset Boring Tool

The small and accurately adjustable offset boring tool holder for tool and jigmakers' use, shown in the accompanying illustration, is made by the Art Tool Co., 16 Montgomery St., Bridgeport, Conn.

The body of the tool is made of



"ART" ADJUSTABLE BORING TOOL

mild steel, pack-hardened and ground. The shank fits the ½-in. collet of the toolroom or bench lathe. The crossslide is made to fit the apparently round hole in the body, but this hole is not round below the counterbore for the dial; it is so shaped as to present two flat parallel bearing sides, against which the slide is held by the pressure of the two small coil springs.

The dial is so graduated as to read in thousandths of an inch upon the diameter of the hole being bored. Tools made of drill rod are used, and are held in the slide by a hollow head setscrew. The screw that binds the

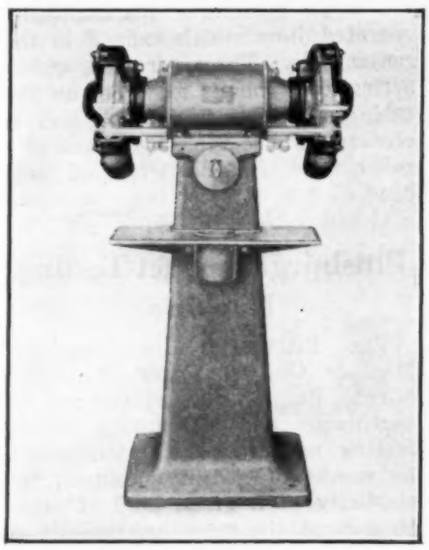
cross-slide after each adjustment has a hollow head also, but is made like a fillister head screw and is tapped into the opposite side of the yoke in such manner as to draw the sides of the yoke together. This gives a firm hold upon the slide.

One wrench is used to manipulate both set and binding screws, as well as to turn the adjusting screw.

Hisey-Wolf Grinder Improvements

The line of grinders manufactured by the Hisey-Wolf Machine Co., Cincinnati, Ohio, are now furnished with an improved design of combination wheel guards, and a form of motor starter which is superior to the former switch.

A machine with these features is shown in the accompanying illustration. The wheel guards are interchangeable with the standard open-type guards, and are fitted with removable end covers and exhaust pipe connections. They are adjustable to any angle, making them adaptable to a variety of work. As the wheel wears the guard may be moved back on its bracket to give full access to the wheel, with maximum guard protection.

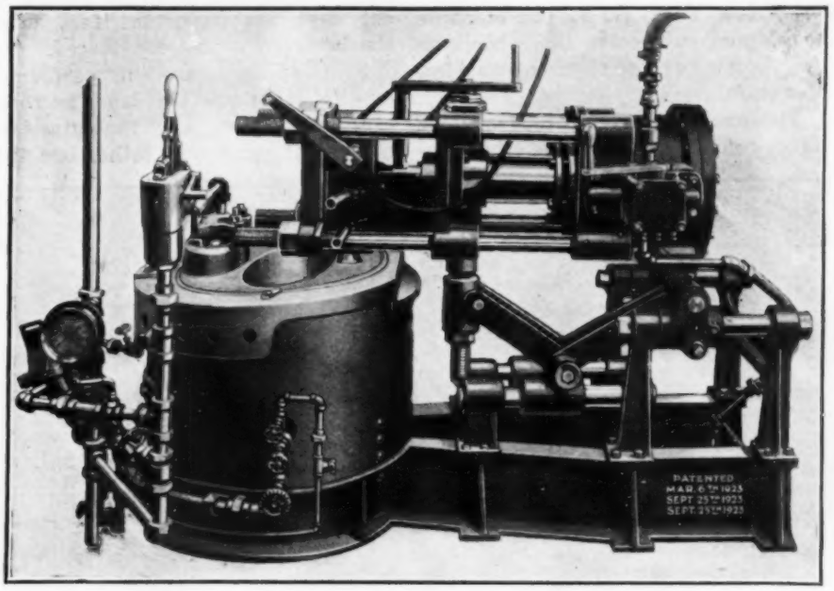


HISEY-WOLF GRINDER IMPROVEMENTS

The motor starter consists of an operating or control button conveniently located at the front of the machine and the switch proper completely enclosed in the base. This method of mounting insures protection and permits access to the switch by removing a cover plate.

Dollin Die Casting Machine

A die casting machine, designed for high production and simplicity of operation, is now being marketed by Edgar N. Dollin, 6 Church St., New York, N. Y. The machine is air-operated, a pressure of 200 lb. being used in the cylinder which operates the die and 400 lb. for shooting the metal.



DOLLIN DIE CASTING MACHINE

The accompanying illustration shows the machine in the closed position. The die sections are fastened to two plates, one of which is held by the four rods attached to the cylinder, the other being fastened to the end of the piston rod. The vertical distance between the centers of the rods is 16 in. and the horizontal spacing is 19 in. The stroke of the cylinder is 10 in., and the greatest over-all die depth is 18 inches.

The die carriage cylinder is 14 in. in inside diameter and carries at one side the valve mechanism for operating the dies. This mechanism is a feature of the machine as it is arranged to provide a back pressure of 100 lb. per sq.in. in the cylinder as the dies are closing, thus insuring steady action. To close the dies the handle is moved from the right to the center.

When the dies have closed the valve is moved to the position shown in the illustration, the back pressure is removed and the full 200 lb. per sq.in. pressure is available to hold the dies together against the pressure of the metal. It is claimed that this action in the die carriage cylinder results in a substantial decrease of the air required for operation.

The metal heating and shooting unit is attached to the base at the left, the pressure end of the goose-neck being at the left of the pot in which the metal is melted. The nozzle is at the right, directly under the die. The pot has a capacity of about 1,000 cu.in. The die can be closely adjusted to the nozzle. Vertical adjustment is obtained by means of the vertical screw and the horizontal adjustment by a rack and pinion at the die carriage pivot.

Goose-Neck Construction

The separate air valve for the goose-neck is located at the left of the pot. The dies are gated on the sides between the die surfaces, a feature which makes the extraction of the casting somewhat easier. The goose-neck is vertical and runs from the air valve under the pot and to the nozzle on the other side. The machine shown in the illustration is arranged to burn fuel oil but gas-burning equipment can be furnished if desired.

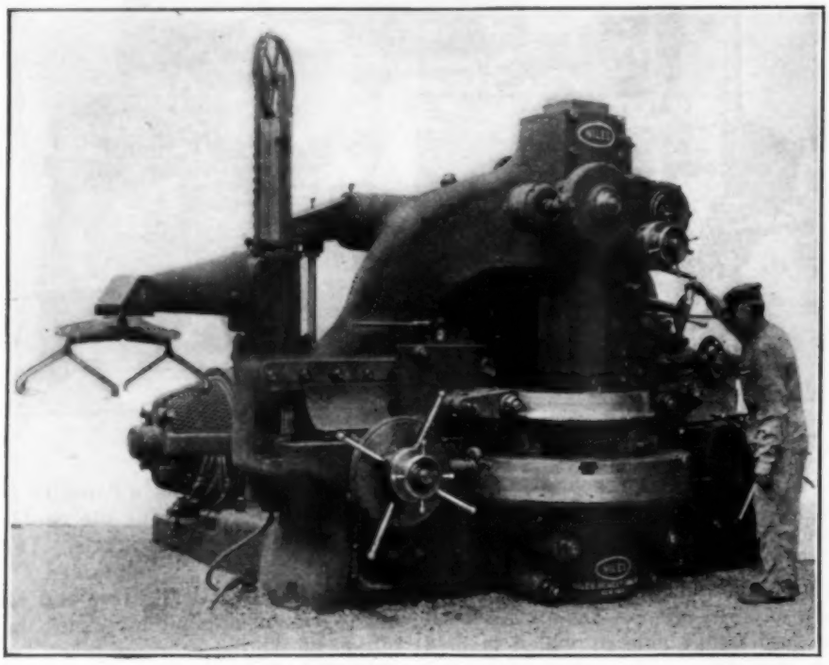
It is stated that the product is close-grained and well-finished due to the methods of heat regulation and air application, and the goose-neck construction. The machine may be used for large or small castings with a variety of metals at equal efficiency. Pots and dies can be easily and quickly changed.

The floor space required for the machine and two operators is about 9x10 ft. The shipping weight is 3,500 pounds.

Niles-Bement-Pond Vertical Car Wheel Lathe

A vertical, single-purpose car wheel lathe for machining rolled or forged steel car wheels has recently been placed on the market by the Niles-Bement-Pond Co., 111 Broadway, New York, N. Y. The machine is adapted to receive the wheels as they come from the hot-working operation.

The operations performed on this lathe consists of turning the contour of the tread and flanges, facing the hub and rim on one side, bossing eccentric hubs where such exist, undercutting the rim and scribing the wear line. All these operations are accomplished simultaneously with the exception of the last, which is postponed until the wheel is finished. The capacity of the machine ranges between wheel diameters of 33 and 42 inches.



NILES-BEMENT-POND CAR WHEEL LATHE

The contour of the tread and flange on a rolled wheel, as it comes from the hot-working operation, conforms roughly to that which it will assume when finished, and the hub has a rough hole hot-punched through its center. All the surfaces retain the minimum amount of stock necessary for producing a good finish.

It is stated that several of these machines are maintaining the record output of 60 wheels a day, about 525 lb. of metal being removed per hour. This amount of work, on the operations mentioned above, formerly required the services of ten machines, so that the reduction in number of machines used is nearly 60 per cent, an important fact when the labor costs are considered.

Some of the operations performed by this lathe are the same as those ordinarily done on the standard horizontal car wheel lathe, but this new machine is designed more on the plan of a heavy boring and turning mill. The horizontal rotary table and long square steel tool bar, adjustable vertically, bear out this rough similarity, but the absence of a cross-rail is a marked departure.

The square tool bar slides vertically in the main housing and carries a tool holder with inserted blades which face off the hub and boss eccentric hubs. A special motor provides this bar with power down feed and power traverse in both directions.

The main right-hand side head rough turns the flange and tread and is provided with power feed. It carries in addition an auxiliary tool head in which are secured the tools which face and round the rim and undercut it, and another tool which later scribes the wear line. Cross and vertical hand adjustment for these tools is also provided.

The left-hand side head makes the finishing cut on the flange and tread. This head has vertical hand adjustment and power cross feed. The feeds to all heads are independent of each other and have automatic trips which disengage the feeds at predetermined points.

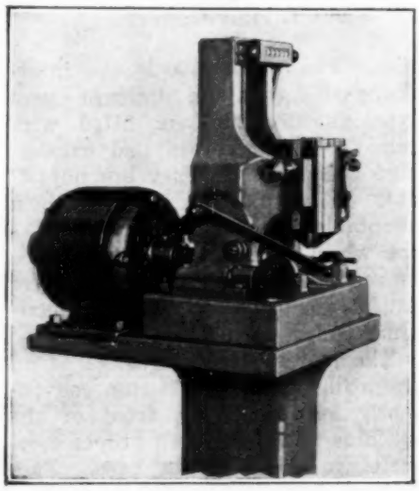
The main driving gear is a Maag-cut spur gear twice the diameter of the table and with a 12-in. face. A variable speed motor with a 3 to 1 range is direct-connected to the machine.

Provision is made at all points for a liberal supply of oil. The lubricant for the table track and the spindle flows by gravity from a reservoir inside the machine, and to a tank from which it is returned by a pump to the reservoir. The main drive gears are enclosed and run in oil. Shaft bearings have sight-feed oilers.

A pneumatic crane for handling the work has three pneumatically operated jaws which expand in the center hole. Three serrated, quick-acting dogs hold the wheel on the table and drive it. The wheel is centered on the table by means of a roller held in the left-hand side head.

Pittsburgh Impact Testing Machine

The Pittsburgh Instrument & Machine Co., 40 Water St., Pittsburgh, Pa., is now marketing its continuous and alternating impact testing machine which determines, by means of a test specimen, the elasticity of a given kind of steel. In general, the operation consists in



PITTSBURGH IMPACT TESTING MACHINE

subjecting a standard shape of test specimen to repeated blows of a hammer, the specimen being rotated a certain amount after each blow and the number of blows required to fracture the specimen being recorded on a counter.

The machine is mounted on a pedestal which is furnished with it, and consists of a frame in which a hammer is arranged to be raised and dropped by the action of an electric motor. The specimen is mounted beneath the hammer and is turned by the pinion and rack device shown in the illustration. The turning device may be set to turn the specimen through a certain angle depending on the kind of test to be made.

For a "continuous" impact test the specimen is turned through 1/25 revolutions after each blow of the hammer, and for an "alternate" test it is rotated through 180 deg. The latter represents the stresses found in crankshafts and the former gives stresses such as develop in railway axles or automobile shafts.

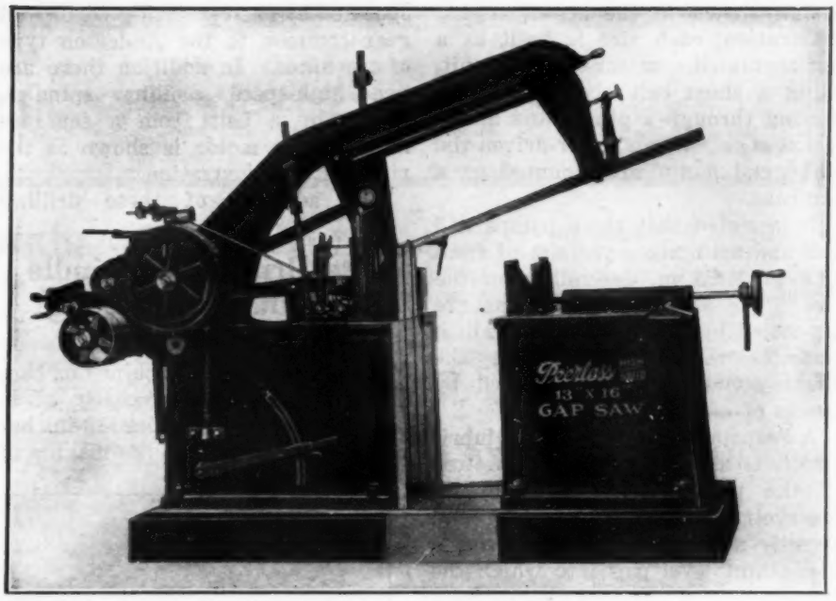
The test specimen is machined to a diameter of 0.5 in. with a round or V-shaped notch reducing the diameter at one point to 0.4 in. The notches must be well polished. A shaping tool, jig and micrometer for preparing the specimens can be furnished if desired.

The hammer weighs 9¼ lb. and the height of drop is 1⅞ in. A d.c. or a.c. motor to run at 1,750 r.p.m. is furnished with each machine. The net weight of the complete machine is 300 pounds.

Peerless 13x16-In. Gap Saw

A power hacksaw, which is called a gap saw on account of the unusual construction of the bed, has been recently placed on the market by the Peerless Machine Co., Racine, Wis. As shown in the accompanying illustration, the feature of the machine is the bed or frame, a section of which is arranged to be slid forward on a machined pad giving an excess work-holding capacity of 24 in. in height and 16 in. in width.

When the gap is closed the saw can be used for ordinary purposes. With the gap open a piece of steel 16x26 in. can be sawed in two by sawing through 13 in. and then meeting the cut by turning the piece over. The machine is also adapted for blocking out hammered forgings prior to the machining operations.



PEERLESS 13X16-IN. GAP SAW

The work can either be clamped to the vertical finished face of the bed where four T-slots are provided for the purpose, or directly to the base, in which three T-slots are machined. The blade holder will accommodate blades from 14 to 25 in. in length.

The base has a water trough extending clear around its perimeter which carries the coolant back to a reservoir located at the rear. From the reservoir a rotary geared pump forces the coolant up into the pipe which distributes it to the blade. The finished pad on each side of the base opposite the gap is for the convenience of the operator when locating work which is clamped directly to the base. The left-hand edge of the bed is also finished for measuring purposes.

The head and feed mechanism is the same as that used on the standard 13x16-in. saw manufactured by this company and previously described on page 790, Vol. 46, of the *American Machinist*. The head lifts on each return stroke and, at the bottom of the cut, the feed is disengaged and the head is lifted to its uppermost position by the usual arrangement of balance springs. Blade pressure or feed can be varied at will by raising or lowering the ratchet lever at the side of the bed.

The machine shown in the illustration is equipped with the standard six-speed stroke mechanism, which is furnished when the materials to be cut require different cutting speeds. Either this attachment or the usual 2-hp. motor, or both, can be furnished with the machine.

The distance from the floor to the top of the base is 6 in., the top of the table being at a height of 30 in. The machine occupies a floor space of 30x80 in., and the net weight is approximately 3,000 pounds.

Ingersoll-Rand Type 15 Vacuum Pumps

The Ingersoll-Rand Co., 111 Broadway, New York, N. Y., is now marketing a line of small, vertical, belt driven vacuum pumps which are designated the Type 15. These pumps are of small capacities. Six sizes are included, ranging from 4x2 in. to 8x5 in. in the single-acting type, and with 10x5-in. and 12x6-in. machines of the double-acting pattern.

In addition to the standard belt

INGERSOLL TYPE 15 VACUUM PUMP

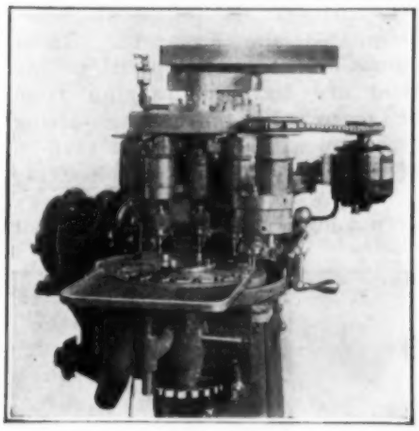
design shown in the accompanying illustration, each size is built as a self-contained, motor-driven unit, using a short belt arrangement or driving through a pinion and an internal gear. When motor-driven the pump and motor are mounted on a sub-base.

It is stated that these pumps will pull and maintain a vacuum of from 28.6 to 29.25 in. depending on the size. The single-acting pumps are air-cooled by an annular ring which encircles the cylinder, while the double-acting pumps are cooled by means of circulating water.

A "constant-level" system of lubrication is used in which the bottom of the pump base forms an oil reservoir. Above the reservoir and directly under the connecting rod is a constant level pan into which the connecting rod dips and distributes a quantity of oil sufficient for proper lubrication. The pan is replenished from the reservoir by a valveless oil pump operated by an eccentric on the main shaft.

Anderson Combined Drilling and Tapping Machine

The Anderson Die Machine Co., 544 Iranistan Ave., Bridgeport, Conn., has recently added to its line the combined drilling and tapping machine shown in the accompanying



ANDERSON COMBINED DRILLING AND TAPPING MACHINE

illustration. This machine is a development of others that have recently been shown in the *American Machinist*, but which were designed for tapping only.

The machine is provided with a feeding dial for handling all kinds of work that comes within its range, has three reversing spindles for tapping, which are adjustable for position and operated by the oscillating segmental gear common to the Anderson type of machines. In addition there are two high-speed drilling spindles, driven by a belt from a separate motor. The motor is shown at the right in the illustration.

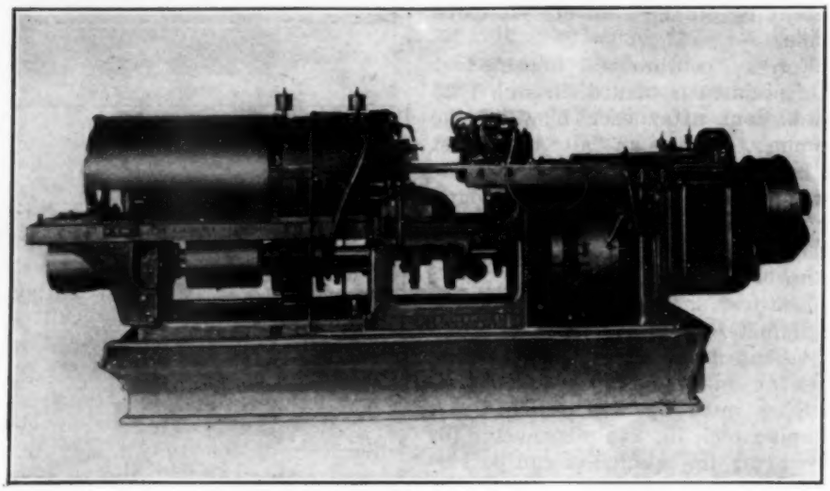
The addition of these drilling spindles enables the drilling and tapping of small parts to be completed in one cycle and thus eliminates one handling of the work, together with the necessary locating fixtures to ensure that the taps will enter holes drilled in a previous operation.

New Britain Six-Spindle Automatic with Long Feed

The New Britain Machine Co., New Britain, Conn., has recently made alterations in its regular 1⅛-in. bar machine to adapt it to the making of longer pieces, and has placed the lengthened machine regularly on the market. The changes have been brought about by the addition of an extra bracket at the turret end of the bed which allows the entire turret mechanism to be shifted endwise and, at the same time, provides space for a longer feed-slide and cam.

The capacity of the lengthened machine for bar stock is 1⅛ in. in diameter by 12½ in. long. The floor space requirement is increased by 2 ft. over that of the regular machine and the length is now approximately 11 ft. 9 in., while the width remains the same; 3 ft. 7 inches. The weight has been increased to 11,000 pounds.

The alterations were made primarily to adapt the machine to the manufacture of armature shafts for small electric motors.



NEW BRITAIN AUTOMATIC WITH LONG FEED

American Trade with India for Seven Months

Analysis by the Department of Commerce of the official Indian trade returns for 7 months ended July 31, 1923, compared with the corresponding period of 1922, shows that the United States is practically holding its market in clothing, general foodstuffs, hosiery, hardware, paints, and some iron and steel projects.

Gains have been made not only in petroleum imports from the United States, but in mining machinery, railway materials, telegraph and telephone equipment and automobiles. On the other hand much of the trade of 1921 has been lost in dyes, leather, boots and shoes, cutlery and paper. Previous to the war 2.5 per cent of India's imports came from the United States. Between 1914 and 1919 world economic conditions increased this percentage, and, when trade began to swing back to normal we were still furnishing 10 per cent of the imports. This was reduced to 9.5 per cent for 1921, 6 per cent for 1922, and 5.6 per cent for the 7 months ended July 31, 1923.

What India Sells Us

India's export trade with the United States rests very largely on the heavy sales of raw and manufactured jute, shellac, manganese, hides and skins, and tea. The total exports of Indian products to America for 1920 were valued at 395,311,000 rupees, for 1921 at 249,487,000 rupees, for 1922 393,328,000 rupees and for the first 7 months of 1923 at 221,380,000 rupees. For the same periods the credit balance on India's trade with America amounted to 74,077,000 rupees, 25,722,000 rupees, 61,815,000 rupees, and 189,000,000 rupees, respectively. This excessively large margin between exports to and imports from the United States is undoubtedly settled to a great extent, however, through triangular trade by way of Great Britain, Hongkong, and other reshipment centers.

News Section

Gary Predicts Six Months of Improving Business in All Lines

Elbert H. Gary, chairman of the board of the United States Steel Corp., called on the business men of the country to support and co-operate with President Coolidge in maintaining stabilized conditions in the industrial world in a speech delivered at the meeting of the American Iron and Steel Institute at the Hotel Commodore Oct. 25.

This was the twenty-fourth annual meeting of the institute, and it was attended by more than 2,000 members, including such prominent men in the industry as Charles M. Schwab and James A. Farrell. The Earl of Birkenhead and Mirza Hussein Khan Ali, the Persian Minister, were guests of honor.

In matters concerning the iron and steel industry Mr. Gary said the outlook was good and that a material increase in the volume of business might be looked for during the next six months. In congratulating the members of the institute, of which he is president, for abolishing the twelve-hour day he gave chief credit to the late President Harding for bringing about the actual inauguration of this step.

Mr. Gary deplored the chaotic conditions in Europe, but said it was his opinion that this country could not be of much assistance in restoring a condition of equilibrium.

In summarizing the conditions in the iron and steel industry at the present time, he said:

"For the calendar year the iron and steel industry will show considerable profit, though not as much as the capital invested should produce. The new orders are not up to productive capacity, but together with those heretofore accumulated, have resulted in large shipments. In some lines the demand for immediate consumption has been, and still is, in excess of the ability to supply.

"It may be stated with confidence that the outlook is good. Inquiries for iron and steel are unusually large, many of them urgent. Purchases for railroad and general building purposes, for oil development and production, for canning purposes, for the automobile trade and many other lines are now very large as a total and from appearances may be expected to materially increase in volume during the next six months, unless something unforeseen and unwarranted shall be precipitated."

Johansson Joins Ford Motor Company

Carl E. Johansson, manufacturer of gage products, which are standard instruments of exact measurement throughout the world, has arrived in Detroit and has assumed his new connection with the Ford Motor Co.

His gage plant at Poughkeepsie, New York, where the standard instruments are made, was recently purchased by Henry Ford, who is rapidly securing control of the manufacture of everything needed in the production of Ford cars and tractors.

Mr. Johansson's headquarters will be at the Ford plant in Dearborn and when the new Ford laboratories are completed his experts who came to this country with him from Sweden, will join him here.

Executives in the automotive center believe that his connection with the Ford Motor Co. is one of the most important steps taken in this line by any Detroit manufacturer in some time.

Professor Roe Speaks on Management

Management is entering a period of revolutionary development due to the invention of methods of measurement, Prof. Joseph W. Roe, head of the Department of Industrial Engineering in New York University, and member of the executive board of the Federated American Engineering Societies, declared in an address at the Engineering Societies Building on Oct. 23.

Industry must set up practicable standards of measurement for managerial functions to avoid mistakes which become more disastrous as production increases and to meet widening world competition, said Prof. Roe. "To compete with foreign labor," he added, "American productive facilities must be used to maximum advantage."

The meeting, arranged under the auspices of the American Society of Mechanical Engineers and other organizations, was one of a series of Management Week gatherings which are being held in the principal industrial centers of the country.

Alexander Talks to Business Publishers

Magnus Alexander, chairman of the National Industrial Conference Board, was the speaker at the annual meeting of the New York Business Publishers Association held at the Machinery Club, New York City, on Oct. 22. Mr. Alexander has but recently returned from a trip through Europe where he studied economic conditions in Germany, Austria, Hungary and France. His lecture concerned the present European situation and America's attitude toward it.

Edwin A. Scott, president of the Edwin A. Scott Publishing Co., was elected president for the coming year. George Griffiths, *Hardware Age*, was elected vice-president, and J. H. Moore, Robbins Publishing Co., secretary. Edgar J. Buttenheim, *American City*, was re-elected treasurer. The board of directors includes the present officers and three newly elected: J. H. Bragdon, *Textile World;* Edward Mehren, McGraw-Hill Co., Inc., and Franklin Johnston, *American Exporter*.

Textile Mills Buy in the South

Atlanta machine tool jobbers advise that the volume of sales experienced a slight increase the last two weeks of October as compared with the first half of the month, but state that there is still room for a great deal of improvement, and that conditions in October were not as satisfactory as indications portended they would be about six weeks ago. October sales of machine tools were off somewhat on a comparative basis with September, but with most of the larger distributors proved to be a little better than they were in October, 1922, though the reports of the dealers vary widely, one reporting a substantial betterment, a second only a slight improvement, and still a third stating sales were about the same. Nearly all of the leading distributors agree, however, that the outlook is quite promising throughout the Southeast, due to the fact that industrially and from an agricultural standpoint, the district is in better shape financially than for several years.

Improvement Evident

Quite an improvement has been noted the past month in sales to the textile industries, with the smaller machine shops still proving active buyers as they have for some months past.

However, where heavier machine tools have not been in as active demand as the trade had anticipated, smaller tools, machine tool parts and kindred mill supplies have been in substantially better demand the past two weeks, with this business about the best it has been in several months, and the outlook portending a continued steady demand through the rest of this year and into the early part of 1924. Nearly all the dealers handling supplies of this type seem agreed that there has recently been a substantial improvement in sales of this nature.

The cotton crop is now being gathered, and while it will not be the largest the South has ever produced by any means, with the present price close to 30 cents per pound it is certain to net the producers the largest gross sum they have ever realized from the sale of the staple, possibly excluding the inflated times that prevailed during the latter part of the war. And as business and industry always are closely rooted to the fortunes of cotton in the South, this condition will undoubtedly mean a period of industrial and commercial activity.

A. G. M. A. Puts Through Constructive Program at Mohonk

LIVING up to its past record the American Gear Manufacturers Association carried through at its Fall meeting at Lake Mohonk, N. Y., Oct. 25, 26 and 27, a long, constructive program without flagging interest. There is a spirit about the A.G.M.A. that marks this young association as one of increasing influence and which is having a beneficial effect, not on gear makers alone, but on the metal working industries at large. Ably directed, the association and its committees are meeting the serious problems of its own and allied industries with inquiring minds. Each member who attended at Mohonk went away a better gear man and more truly understanding industry, and it is regretable that not more than the hundred and twenty-five or so who attended could have been there.

Mr. Markland Optimistic

George L. Markland, Jr., the new president, conducted the sessions like a veteran, as was expected of him. In his opening remarks he sounded a note of optimism that met with approval when he said, "You will recall that two years ago the pessimist and the croaker were busy working overtime, and their tribes were legion. Whereas today he is still in evidence, there is less of him and he sings rather small; his voice is not loud and raucous. I wish I could imbue you all with a smiling optimism, which, while recognizing the necessity for caution in your business ventures, refuses to be cowed by the howling voice of pessimism. . . . Consider our own business, that of making gears. There will always be gears to make and in increasing quantity."

Most of the time during the four general sessions was given to the reading and consideration of reports of the committees and sub-committees, whose work along standardization and other lines represents an immense amount of effort on the part of the individuals composing them. Very satisfactory progress has been made, of which a résumé will be given in a later issue of the *American Machinist*.

Member-Companies Elected

The following new member companies were elected: Western Gear Works, Seattle, Wash., R. C. Frankie, representative; United Engineering and Foundry Co., Pittsburgh, Pa., Lane Johnson, representative; Universal Gear Works, Detroit, Mich., Frank J. Brown, representative; Automobile Machine Co., Cleveland, Ohio, J. Kreusler, representative; Barber-Colman Co., Rockford, Ill., F. G. Hoffman, representative; David Brown and Sons, Ltd., Huddersfield, England, Francis Edwin Brown, representative. Myron A. Allen was elected as an additional representative of the Brown-Lipe Gear Co., of Syracuse, N. Y. I. W. Sprink was elected as associate member from the Automotive Gear Works, Inc., Richmond, Ind., in place of W. H. Lyman, resigned. Judge Leo J. Doyle and John T. Kerwin were elected as the new representatives of the Foote Bros. Gear and Machine Co., of Chicago. T. C. Roantree was present as a new associate member from the Westinghouse Electric & Manufacturing Co.

The report of E. S. Sawtelle, of the Tool Steel Gear & Pinion Co., Chairman of the Industrial Relations Committee, was warmly received, an indication that the gear men are recognizing the importance of proper personnel relations in industry. In part Mr. Sawtelle said: "Modern business depends more upon men than upon dollars. Given the opportunity of investing in a business with abundantly strong financial resources but with questionable management, and a struggling business but with high grade and trained management, any intelligent man would take the latter as having the best chance for the future. In Europe where business is conservative and old standards are adhered to, initiative is not so important a factor; but in America, the land of opportunity, we find it also the land of the opportunist and the man who forges ahead rapidly is the man just one jump ahead of the rest, seeing things just a little bit sooner than his competitors, flexible in his mind and flexible in his organization so that he is able to keep apace with the swift moving trend of our modern American business.

"No one man can provide all of the ideas or advancements necessary for an industry and if he is able to thoroughly organize his industry from top to bottom with sympathetic, alert co-operation from each and every employee, he has to a large degree solved his problem of personnel. Ways and means to accomplish this should be the primary function of any industrial relations committee. . . . Let us reiterate that no two personalities are the same, no two shops are the same, and that industrial relationship is 99 per cent a matter of applied personality. Hence this whole question is one that each man must solve for himself and we believe that as he approaches a solution he will be working not only for the benefit of his own industry but for a more permanent stability of our whole nation."

Major Earle Buckingham, of the Pratt & Whitney Co., read a paper which he had prepared in conjunction with Ernest Wildhaber, on the analysis of milled gears. This paper, which proved to be of a great deal of interest, will be printed in full in the *American Machinist*.

Education Discussed

That the members of the association are sincerely interested in educational matters was indicated by their reception of the talk by John P. Kottcamp, head of the Department of Industrial Engineering of Pratt Institute, of Brooklyn. Mr. Kottcamp's experiences and observations evidently had been the experiences and observations of many members of the association. His talk was to the effect that just as a good gear cannot be made from inferior raw material, a man capable of filling a responsible position in industry cannot be made from the boy who, through faulty education and improper selection of vocation, has not the proper foundation for the task at hand. The remarks were constructive in every way.

After the association dinner on Friday, S. L. Nicholson of the Westinghouse Electric & Manufacturing Co. told of business conditions in New Zealand and Australia. R. M. Hudson, of the Division of Simplified Practice, Department of Commerce, read a paper on simplified practice as service to American industry. His examples of waste in industry that has been eliminated by simplification, must have furnished considerable encouragement to the hard working sub-committee of the association.

At the final session E. W. Miller, of the Fellows Gear Shaper Co., Springfield, Vt., read a paper on the development of the gear industry. Mr. Miller's purpose was to show new applications of gears and to indicate the possibilities of greater gear business to the alert manufacturer.

A discussion by the industrial group followed the last general session. Announcement was made that the Spring meeting will be held April 28, 29 and 30 in Buffalo at the Lafayette Hotel. It was announced also that a cup will be given the member making the best golf score at the Buffalo meeting.

Management Week Held in Chicago

From Oct. 22 to 27 Management Week was observed by Chicago engineers, the program having been arranged and carried out under the auspices of the local sections of the American Society of Mechanical Engineers, the National Association of Cost Accountants, the Society of Industrial Engineers, the Taylor Society and the Western Society of Engineers.

Good Speakers

The opening session, with a record overflow attendance, was held in the auditorium of the Western Society of Engineers. Bion J. Arnold presided. "The Story of an Automobile" presented in an excellent six-reel film showing the various steps in the making, assembly and testing of the Studebaker Light Six served as an interesting introduction, as it showed the equipment of one of the most modern plants in the country and the ingenious labor-saving machines and methods employed. W. C. Hoover, engineer of the B. F. Goodrich Co., followed with an address, "Multiplying Man Power by Mechanical Means."

On Thursday a dinner meeting at the City Club was devoted to "Non-Mechanical Means of Increasing Man Power," with W. L. Abbott, chief operating engineer of the Commonwealth Edison Co., acting as chairman. Four speakers were allowed twenty minutes each to cover different phases of the major subject. J. D. Cunningham, speaking for the American Society of Mechanical Engineers, urged the engineer to analyze himself, to improve in salesmanship of his own abilities and to take the more active part in management that his qualifications warranted.

Hugo Diemer, representing the Taylor Society, outlined the different phases of industrial relations and personnel work and by numerous data and statistics showed how they had become vital factors in increasing man power. W. B. Castenholz offered a few concrete examples to show how the accountant helped in management. H. N. Stronck pictured the growing field of the industrial engineer.

Production Meeting of S. A. E. Proves Interesting and Instructive

THE second production meeting of the Society of Automotive Engineers was held at the Hotel Winton, Cleveland, Ohio, Oct. 25 and 26, both sessions being well attended. There were three sessions the first day devoted to machine tools, factory managers and scientific management.

During the first session, E. P. Blanchard of the Bullard Machine Tool Co., Bridgeport, Conn., gave an illustrated talk, "Fundamental Principles in Modern Production Machines." He pointed out that with a given tool and similar material, the actual cutting time of one tool was the same regardless of the machine in which it was used. He then traced the application of multiple tooling and the elimination of time between cuts as exemplified in the Bullard "Mult-Au-Matic" and "Continumatic," both of which are familiar to our readers. These, he pointed out, accomplished the two fundamentals of rapid production, division of labor, and transference of skill, the two essentials named by Adam Smith in his treatises. Questions were numerous, some of the inquirers desiring information as to the minimum number of pieces for which the piece can be tooled economically and others as to the accuracy which can be obtained.

A. J. Ott and his son C. L. Ott of the American Grinder Co. presented a very interesting paper on gear tooth grinding, showing their new machine, which uses a 30-in. wheel, placed below the work and capable of being swiveled so as to form both sides of a rack tooth in grinding either side of the gear tooth. The paper and the questions answered brought out the fact that an allowance of 0.005 in. would generally take care of the distortion due to hardening, while from 0.002 to 0.005 in. would usually clean up a tooth in grinding. The desirable amount of backlash was given as from 0.005 to 0.01 in. per tooth, or a total of from 0.01 to 0.02 in., depending upon conditions. About 60 teeth can be ground with one dressing of the wheel and at the rate of about 5 sec. per side of tooth. Wheels of 66 combination J or 66-50 J were recommended. It was generally conceded that grinding adds to the life of the gears.

Grinding in the Auto Shop

The developments in the automotive industry were reviewed very interestingly by Oscar A. Knight of the Norton Co. who traced briefly the developments and progress in grinding. He showed new machines and told of the effect of various elements on grinding finish. Gears, unbalance of wheel and other factors were discussed. Crankshaft grinding, piston grinding, etc., received much attention, Mr. Knight tracing the reasons why grinding crankshafts from the rough had, under present conditions, given way to rough turning. Wheel wear varies from 0.025 to 0.05 in. per crank on a rough forging, while on finishing pins the wheel loss per pin is only 0.0006 in. The development of the broad wheel, which is fed straight in was discussed.

The question of grades of finish and of polishing or lapping crankshaft bearings was brought up and Mr. Pletz, of the Morris Machine Co. told of the work of that company's machines in several large plants. One maker of motors polishes or buffs all his engine bearings in the direction in which they are to run, so as to lay any tooth or particles, no matter how small, in the right direction.

W. T. Jameson of the Cleveland Automobile Co. presented a paper, "Human Element in Production," a most timely subject. He pointed out the advantages of securing concentrations on the work and the bad effect of inertia on all of us. It was a careful study of the effect of securing interest of the men to the point where they felt they were working for themselves, but unfortunately he did not give any specific instances as to its application. He claims to have secured co-operation and increased results with no other incentive than a man's satisfaction in a job well done and the knowledge that he is a better man and better workman for having done it.

Conveyor Machinery

H. P. Harrison then showed how the installation of conveyor equipment had aided production in the plant of the H. H. Franklin Manufacturing Co. at Syracuse. He frankly told of the mistakes they had made in selecting the wrong type of conveyors for some places and said that for comparatively small production he did not favor power-driven conveyors for carrying work between operations. They had found gravity conveyors best for such places. Power conveyors were, however, used between departments.

Mr. Harrison also pointed out a very important fact in connection with the use of conveyors—the reduction possibility in the number of pieces in process at one time. In the transmission case installation the number had been reduced from over 700 to 150. The effect on the inventory is no small item. The use of conveyors also helps foremen to keep track of the production. Each case should be studied by itself.

Eugene Bouton of the Chandler Motor Car Co. told of the group bonus plan in use in the Chandler plant. A group is the number of men needed to complete one unit, such as a connecting rod. The groups range from three to 92 men. A straight piece work price is allowed for each complete unit. The men are divided into three day rates. The output of the group is divided by the rate which would have been earned at the day rate, the result being a factor by which each man's share is easily calculated as the men are paid pro-rata, according to their rate. The men can know in the morning their earnings for the day before, if they desire.

Interesting the Workmen

The plan outlined has reduced both labor turnover and scrap. In addition it puts the question of discipline largely up to the men themselves, as they watch production closely. It is to their interest to work as few men in a group as possible, to teach new men gradually and accurately and to weed out the slow men or the men who are apt to shirk on the job.

In the evening, Percy S. Brown, works manager of the Corona Typewriter Co. gave a detailed but very interesting account of the production control methods used in the Corona plant. A similar paper by the same author was published in the *American Machinist*. Mr. Brown was the representative chosen by the Taylor Society to speak at the S. A. E. meeting.

The first paper of the second day, "Standard Machines for Quantity Production," by Ralph E. Flanders, the newly elected president of the National Machine Tool Builders' Association, proved excellent. Reliability and comparatively low cost were pointed out as two of the reasons for using standard machines or semi-special machines made from standard units. The cost and unreliability of special machines built hastily from special designs were pointed out as factors to be carefully considered.

Standard Machines

In connection with the machines themselves, Mr. Flanders spoke of the design of special tools and fixtures and suggested that these could in many cases be best handled in the shops of the user. This was particularly true in shops which standardized its machine equipment as far as possible so that the tool designers could become thoroughly familiar with the characteristics of the machines used. He feels that this makes for lower first cost, fewer repairs, flexibility in production scheduling and the handling of operators and the securing of more satisfactory men. Mr. Flanders also made some valuable suggestions for the next production meeting.

Albert F. Shore presented a very painstaking paper on the standardization of methods of applying the sclerescope, replete with diagrams and laboratory tests. He took up the various problems connected with the use of the instrument and urged standardized methods of using so that the results obtained in one shop could be compared with those secured in others.

Machine Tool Data Sheets

Although not on the program, A. L. Evans addressed the meeting regarding the use of standard machine tool data sheets by all users of such machines. This subject is already being considered by the National Machine Tool Builders' Association and it is quite probable that the Society of Automotive Engineers will appoint a committee to work with the association first named.

The last paper was by A. H. Frauenthal of the Chandler Motor Co. on factors governing out-of-roundness measurements in which he showed some of the problems in measuring both regular and irregular variations. The "regular" errors may be classed as ovals, while the irregular errors are usually modified polygons with varying sides. He showed the use of amplifying gages in connections with standard 90-deg. V-blocks and also with special rests for detecting other errors.

Four visits were organized and the transportation problem was efficiently handled by the local committee. The plants visited were the American Steel & Wire Co., the Chandler Motor Car Co., the National Malleable Castings Co. and the White Motor Co.

The dinner was held at the Hotel Winton, H. W. Alden being toastmaster and R. H. Grant of the Delco Light Co. the principal speaker. Jack Raper of the Cleveland *Press* was also in evidence with a humorous speech regarding mass production.

October Sales Show Increase in the Chicago Market

Machine tool dealers continue to find business dull in the Chicago district. Used machinery has been in slightly better demand this week. A few dealers report a slight improvement. The Chicago, Rock Island & Pacific R.R. has purchased a 36-in. shaper and a 5-ft. radial drill. The Chicago, Indianapolis & Louisville R.R. has entered the market for a 300 cu. ft. air compressor; a double head bolt cutter to cut 1½ to 2-in. bolts; a 3-ft. radial drill; a 5-ft. radial drill; and a motor-driven wet and dry grinder. The Southern Pacific is in the market for three engine lathes for its Western shops. The Union Pacific R.R. has ordered a 5-ton self-supporting jib crane. The Chesapeake & Ohio R.R. has purchased six 150-ton steam wrecking cranes. The Pennsylvania R.R. has placed an order for a 100-in. boring mill; two 42-in. boring mills and a heavy 42-in. x 16-ft. planer. The Illinois Central R.R. is making inquiry for one 1½-in. to 6-in. motor-driven tube cutting machine for use at Vicksburg, Miss. and one 54-in. heavy duty motor-driven lathe for use at Waterloo, Iowa. The Pettibone-Mulliken Co., has purchased a multiple spindle press, a broaching machine, a heading and forging machine and a die sinking machine.

Sales of machine tools and machinery thus far in October are slightly in excess of sales during the month of September.

Structural steel demand is active in the Chicago district, with fabricators figuring on an unusually large number of projects. October business is showing a marked improvement over September, which was a quiet month in the shape market.

While a number of important projects in Chicago are still being held back, it is expected that the present month will be one of the best in some time. Most of the awards during the last few weeks have been small, but the aggregate tonnage is large.

Cleveland District Shows Gains

Significant of the predictions made a month ago for the last quarter of 1923 in things industrial, is the fact that these predictions are being realized in improved business conditions generally in the Cleveland district since the first of October.

From the machine tool manufacturer's viewpoint, the year will round out more satisfactorily than the most optimistic could have hoped for six or even three months ago. This is based upon the larger number of inquiries which are being received by Cleveland plants and distributors and which are being followed fairly consistently by orders. In the main this new business is confined to small equipment, for small producers, yet this is taken to indicate a return to more normal needs of the larger manufacturing interests later.

From the Cleveland machinery producer's viewpoint the most encouraging feature is the return of the railroads as buyers of rolling stock and motive equipment, which will reflect at an early date in orders to manufacturers of that class of requirement, and in turn to increased iron and steel needs. Already this last is showing itself in more orders though caution is manifested. Orders are small, and hesitancy still is the rule rather than the exception. Withal this angle shows a 20 per cent gain so far in October over September, and twice the showing made in August.

Automotive Activity

The influence of the automotive industry upon machinery interests cannot be emphasized too strongly, however, for it is here, if anywhere that the real improvement in equipment demand can be looked for.

Encouragement for the industry can be gleaned from the statements made by Alfred Reeves, general manager of the National Automobile Chamber of Commerce before the Cleveland Automobile Manufacturers Association last week, at which some machinery factors were present. Based upon the production of more than 3,000,000 motor cars during the first three quarters of 1923, Mr. Reeves predicts that the production will make the 4,000,000 mark during the last quarter, since absorption of the product has not diminished as in former years at this time. This will make for a 50 per cent gain over 1922, he points out.

In line with this comes the more definite figure that Cleveland automobile and automotive parts interests have increased their operating staffs 7 per cent in the last few weeks. This is amplified by like condition in Canton (normally considered in the Cleveland district) plants which serve the automotive industry. Most plants report gains in the last week or so for their particular products, so that they are operating now about 90 per cent of normal, while the eighteen Canton foundries are operating at about two thirds of their capacity, which is considered exceptionally good.

Expansions Noted in Indiana

In spite of pessimistic warnings, conditions appear to be improving throughout the entire Indiana territory. During the last few months expansion has been limited. Many men prominent not only in the machine tool and machinery business, but in those industries that are the biggest users of these commodities have been dubious about expansions of any nature. Warnings have been sounded by prominent bankers in Indiana. These warnings insisted that too rapid expansion was dangerous and the effect has been decisive. Now, with Winter almost present, trade volume holding its own, and with orders increasing instead of decreasing, there is a tendency to disregard these late Summer warnings and do what ordinary business men do when they receive orders, namely, fill them and as necessary make plant improvements in order to fill them.

Practically the only trade that is showing any present tendency to curtail production is the automobile industry. And this is being done only after one of the best Autumns in the history of the business in Indiana. With some judicious price reductions, the automobile plants—playing to the closed body trade—have had a wonderful season. Only within the last week have signs been seen indicative of a curtailment of orders. The demand for machinery, both used and new, in printing plants is rather remarkable. Machinery men here say that last month has seen a big increase in inquiries for this sort of machinery.

The plant of E. C. Atkins & Co., in Indianapolis, is busy filling back orders even though the lumber mills and similar factories are supposed to be curtailing their production. The woodworking factories, of which the furniture plants are the biggest buyers, are working to capacity with sufficient orders to keep them busy until in the Winter and they are buying specialized machinery to be used in their plants. The railroads are transferring their rehabilitation programs from outside to inside the shops now and tool trade is said to be very good in the several shops here.

Labor Is Scarce in Connecticut

Connecticut manufacturers of automatic labor-saving machinery report that their production requirements are most satisfactory and that there are no indications of any slowing up of business. Inquiries are very favorable and contracts are being made in consequence. The present time shows good automatic machinery buying.

"There is no urgent demand necessitating increase of our working force, but if there was I do not know where we would get skilled men," said one of the manufacturers, adding that it was commented upon by the employment bureau director of his organization, that there had not been an applicant in his office in two weeks. "Even the slacking up of some of the branches of the trade in New England and the curtailing of working hours has not sent any men around," he said.

Some of the Connecticut dealers in rebuilt machinery report a considerable business for the first three weeks of October. The volume of transactions by one of the organizations was reported as the equivalent of the total of any two months of the current year, and the business has been consistently good since the first of January. The total business for 1923 even now surpasses that of 1922.

Water Shipments

A noticeable increase in freight shipments by water was commented upon by a representative of a navigation company a day or two ago. Considerable of it was destined for transfer at New York for reshipment from there to other ports.

There is every indication that the present busy condition will continue for at least three months and some say perhaps six months.

New York Sales Better Than at Any Time Since June

October proved to be a better month than September in the volume of sales made by most machine tool dealers in the New York district. The first ten months of the year have shown rather a remarkable course in the industry in the Eastern part of the country. January and February did not open up to any particular brisk business. March showed decided signs of life. April and May proved to be the big months of the year and in some cases the biggest since the War. June developed a steady business with a drop felt in July and August. September came partially back with good business recorded but the reports were spotty, dealers being at a variance on the month as a total. October opened to brisk business and this trend continued throughout the month bringing business back to the steady level of June.

That orders follow inquiries is clearly shown. In the early part of September it was reported that inquiries were plentiful and during the first part of October sales to a like amount were reported.

The railroads are still buying and there are a few good sized lists out in the Metropolitan district. The American Locomotive Co. has recently been ordering single tools and the General Electric Co. has also been in the market during the past week for a few necessary tools. The automobile factories have sent out interesting inquiries and Southern textile mills have contributed a few orders.

Used tools are finding a fairly good market among the electric street car companies, but it has been difficult recently to secure tools.

Export business has improved during October which is considered exceptional at this time of the year.

Slight Increases in Cincinnati

The production of machine tools manufactured in Cincinnati shows a slight improvement during the past two weeks, although the volume of business being done is only fair. The slump in orders which hit the machine tool houses recently has eased somewhat, leaving conditions more favorable for future business. The main stimulus that is being felt is the buying done by the automobile factories. The production of automobiles is being maintained on such a large scale that the manufacturers have been rather heavy purchasers in the local machine tool market. It is expected that the volume of orders being placed by the automobile companies will show a decrease as the end of the year approaches, but the quantity of machine tools going to the automotive industry has been the chief factor in keeping up production.

Several of the largest machine tool manufacturers state that their business during October has been better than in September and they are much encouraged by the trend of their production. On the other hand, some state positively that business has been dull throughout both September and October. The outlook for the rest of the year for the Cincinnati machine tool industry in general is for a continuation of the present scale of manufacture which can best be described as fair.

Railroads Not Buying Much

The manufacturers of planers say that the orders now on their books and the number of inquiries being received indicate a continuation of the present spotty business. Railroads have not been in the market lately to any extent and it is extremely doubtful whether they will do much buying during the next few months. Some orders for planers are being received from automobile body manufacturers. Milling machines have shown more activity lately and have been in better demand than they were. Lathes are having a slow market in most cases, although several firms report that they have had some good orders for lathes during the past ten days.

The electrical tool manufacturers state that their business is holding up well in volume. Inquiries have been numerous and actual sales have been satisfactory. Conveying machinery concerns also report that their production is going along at a good rate and that orders are coming in in good quantities. Woodworking machinery manufacturers say that their business is good and they have some good orders on hand at present. The used machinery market continues to show improvement.

Business in the metal trades has eased slightly during recent weeks, but this lull is expected to be temporary. Mill and factory supply houses report business as fair, but orders are usually placed for immediate delivery. Tinware manufacturers, especially those engaged in the manufacture of special lines, report business good and have considerable future orders booked. There has been but little change in the pig iron market. A slight increase in inquiries has been noted.

Active Market in Philadelphia

A general tone of optimism prevails throughout the industrial centers of Philadelphia, with the approach of the end-of-the-year season. There was a little improvement noted in the machine tool manufacturing situation last week, compared to two weeks ago, when a slump from the large volume of midsummer and early Fall business appeared.

A larger number of inquiries have been received than in the previous two-week period, leading the manufacturers to the belief that buying will be resumed early in the New Year. The railroads have not been purchasers, and probably will not resume buying to any considerable extent for the present, say the manufacturers and jobbers, but general industrial developments appear to justify the hope for the beginning of a substantial volume of business early in 1924.

The best news of the week was the story that the Southern Pacific Railroad had placed orders for 43 locomotives. Of this number 25 will be built by the Baldwin Locomotive Works, and 18 will go to the American Locomotive Co. The Baldwin order is for 17 freight engines and 8 passenger-carrying equipment. This is a $1,500,000 job, one of the biggest domestic orders received by the Baldwins for several months.

Steel rail orders amounting to 35,000 tons, representing an expenditure of $1,505,000, have been placed by the Philadelphia & Reading Railway for 1924 delivery. The equipment is for extensions and improvements. The Bethlehem Steel Corp. received the bulk of the order, 25,000 of the 130-lb. rails, while the Carnegie plant of the United States Steel Corp. will roll 10,000 tons of the 100- and 130-lb. rails.

The general business situation is satisfactory. Orders in most mercantile and industrial lines are coming in slowly, but a reasonable trade is apparent. The general opinion prevails that there will be an increase for the remainder of the year. Hardware manufacturers and dealers report a fair business in all lines. Manufacturers of ice-making machinery report an improvement, with a considerable volume of exports. Recent shipments have been to Hawaii and to India, with inquiries from Mexico and Central America. The railroad repair shops are operating on a normal basis, and highway construction and county road work is keeping common labor employed.

All Factories Busy in Detroit

All production figures of Detroit's automotive plants are being broken. There is every indication in the business field that Detroit's phenomenal prosperity for this time of the year is not merely a flash in the pan, but is an index of a healthy condition which will keep the city's production up to the maximum for months to come.

Machine tool manufacturers feel that signs of increased activity insure a period of crisp business. Additions to plants are being rushed to completion and manufacturers are planning on production programs such as they have never had before. Noteworthy among the industrial activities of the past week was the arrival in Detroit of Carl E. Johansson, whose gage blocks are standard instruments of exact measurement throughout the world, who comes to assume an executive position with the Ford Motor Co.

Traffic on all the railroads throughout the state continues heavy with car loadings at a high figure. Shipments are being hastened by every manufacturer in the hope that a large stock of raw material may be on hand before bad weather makes receipt of shipments at anticipated times more or less doubtful.

Employment runs about the same, although the week ending Oct. 23 shows a slight increase over the previous period. Figures announced by the Employers' Association show that Detroit firms, members of the Association, are employing 214,278, as against 214,022 for the previous week. This is an increase of 256. According to officials of the Association this is likely to represent the average employment for some time to come.

The Industrial Review

First nine months of the year show business ahead of 1922—Electrical lines in good condition —Street railways better off—Coal mines buying machinery

FROM nearly every machine tool center in the United States the reports show that business during October was an improvement over that of the preceding month. In some spots the improvement was slight, while in others business was much better than the volume done in September. Predictions made last Spring that business would be greatly improved in the Fall and that an early return after the Summer lethargy have not been fulfilled. The return to business was slow and delayed, and the improvement has been gradual. However, a comparison with the same time in 1922 proves that both production and sales are far ahead this year and that a steadier trend is the result. The rush of orders last Spring was admittedly abnormal —even verging on a boom—while business that was done during October, though of a smaller volume had more the character of stability and nearer approached pre-war conditions.

None of the bad elements of 1920 are present today. War stocks have been fairly well absorbed. There has been no overstocking of machine tools. Production has not been allowed to "run wild" while orders lagged. The spirit of speculation as to the future has been curtailed. Optimism has been a cautious, well-founded optimism, not built upon false hopes and desires.

Automobile production showed a slight decrease in September over August, approximately five per cent. But on the other hand and saner basis of comparison, automobile production in September was fifty-nine per cent greater than in September, 1922. The three million mark predicted in January for the year was passed before nine months had elapsed and it looks now as if the total for the year would closely approach three and a half million automobiles.

Railroads are still buying in all parts of the country. The promise of the expenditure of more than a billion dollars announced early in the year by the American Railway Association is being fulfilled and recent announcements are that every penny allotted would be spent before the first of the new year.

Japanese buying has been started in the machine tool line for those tools that are necessary and especially for machinery. Other and larger purchases will follow before January. American industrialists are watching avidly the action of the Japanese Diet when it meets on Nov. 11.

Taken as a whole, the machine tool business may be summed up as good with every indication for steady improvement during the next three months; not up to the predictions or expectations of last Spring, but still ahead of last year.

The Electrical Field

In the electrical field it is reported that the General Electric Co. is running thirty per cent above last year's orders and that there is no end to this rate in sight. Motor makers are extremely busy for this time of the year and sales of all sorts of goods for the holidays are above last year's figures. Radio sets, electrical household supplies and wiring for tree trimming has found an excellent market and sells readily.

Heavy electrical machinery and power generators have both enjoyed good business since the first of last year. The only dark cloud at the present time is farm lighting equipment due to the comparative poverty of the farmers in some sections of the country.

Electric Railways

If further evidence were needed of the improved outlook for the electric railways it was certainly furnished at the convention of the American Electric Railway Association held at Atlantic City during the week commencing Oct. 8. The speakers all were optimistic in their remarks and the extent of the space given to the exhibits was greater than at any other convention of the association since its organization forty-two years ago. While little business is ever directly closed at such gatherings, the way was paved for the placing of many substantial orders. The exhibits of buses particularly was a most impressive one. More and more railway men are coming to a realization that the bus is the logical unit to supplement their service and for use where the electric service would not be justified by the density of the traffic offered. the growing use of the bus by the railroads of course means the extension of the field among the railways for the machine tool manufacturers.

> Machine tool sales were greater in all parts of the country in October, electrical goods are finding a better field and holiday buying has started, reports from the electric railway convention show that industry to be improving, buses are becoming a recognized factor in transportation, machinery is being bought by the mines,—especially the coal mines,—and building records show this year still ahead of last.

Motor Buses

Motor buses are proving to be a big factor in every part of the country. Production is at a good rate and the industry is better off at the present than at any other time in its short history.

Mines Uncertain

The mining industry presents a rather uncertain aspect just now. Some expansion is reported, noticeably in Minnesota and Quebec, but more often the reports are coming in that mining is not up to expectations and the future is none too rosy. However, some of this can be blamed on the season and a note of encouragement is found in the fact that the year generally has been good.

Coal mining decreased during the past week and sales of bituminous have been extremely slow. But mines everywhere are buying new machinery and replacing old type machines with the newer and more labor saving models. Railroads report big storages of coal at all points.

Building Records

But whether business is good, bad or indifferent can best be judged by the rate at which industrial building is going on. When plants and factories are multiplying and expanding it is reasonable to suppose that the owners look with confidence to the future. Heavy industrial building not only gives employment to construction men, but also means many orders for machinery and equipment. If on the other hand industrial expansion is below normal, the reverse is of course obviously true.

Contracts awarded on industrial projects in the first nine months of 1924 amounted to $187,648,000 as compared with $133,178,000 during the same period in 1922. While there has been a steady decrease in industrial building since May the total for the year will probably exceed the total for last year. In October of this year, after decided drops, an increase is shown in the chart prepared by the *Engineering News-Record*.

French Like American Locomotives

American-made locomotives are proving as successful in operation in France as they have in America, according to a recent article by M. Lunier, inspector of equipment, Paris-Orleans Railway, in a French publication.

"The Paris-Orleans Railway in 1921 placed in service," he says, "fifty Pacific type locomotives with simple cylinders and equipped with superheaters. Because of the quick delivery required, the order was entrusted to the American Locomotive Sales Corporation."

After discussing the equipment of the locomotives as compared with those used on the French railroads, and technical tests that were made, he continued:

"These locomotives require very little maintenance and are greatly appreciated on this account by the engine drivers and master mechanics.

Give Excellent Service

"The tests confirm the results obtained by American railroads with two-cylinder Pacific locomotives. This type promises excellent service on French roads. These locomotives are simpler and have a smaller resistance to movement than the four-cylinder compound locomotives. Their maintenance is easier. As to their fuel consumption, it has been less, but it may be that they owe this superiority to their higher superheat. At an equal superheat, it would seem that the consumption of the two types of machines would be substantially equal."

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
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THE steadiness of the American markets in the face of the news received from Europe last week furnishes striking evidence of the inherent soundness of our domestic condition. Press reports and private advices agree in predicting that the break up of the German Republic will make it impossible for France to collect more than a tithe of the reparations she claims.

Cabling from London to the New York *Evening Post*, J. A. Spender says: "No one at this moment is thinking any more of reparations. Plainly there is nothing to be recovered from Germany in existing circumstances and if she breaks to pieces nothing will ever be recovered. The urgent question now is whether she can be kept from chaos and conflict which will have disastrous results for all Europe."

The market for foreign exchange has reflected the apprehension thus expressed, for the franc dropped to 5.72¼ cents on Tuesday, and sterling sold at $4.47¼ the same day, at which figure it was lower than it had been since November, 1922.

Here and abroad it is generally believed that France will be unable to pay her debts if she fails to collect anything from Germany and that the result will be the further depreciation of the franc and a brief period of inflation followed by the inevitable collapse. This would mean that Great Britain and the United States would have to write off what France owes them.

To this country the loss would not be serious, but to Great Britain it would be a great hardship. Therefore it is not surprising that private cables from well informed English bankers and merchants insist that the British Government will be compelled to yield to the demands of the labor party and resort to moderate inflation by issuing a large loan whose proceeds will be used to employ the unemployed in the construction of public works, such as roads and rocks. Lord Beaverbrook, who is said to be the most powerful man in England at present, is in favor of this policy and it is being actively urged by the newspapers under his control.

It may mean sowing the wind and reaping the whirlwind in the end. There are, however, many who believe that it is wise to resort to the anasthetic of inflation when the pain of poverty becomes unendurable and if England can put her idle hands at work they may be kept out of some forms of political mischief that would be worse than the inflation to which the conservatives are so much opposed.

But whatever the denouement may be it is plain that the financial outlook overseas is grave and prior to 1914 its reaction upon America would have been disturbing. That the only effect here has been to restrain speculative activity without depressing prices is particularly reassuring when the pessimism generated by the widely advertised dullness on the Stock Exchange is taken into consideration.

Prices there have moved but little and the changes have been without significance though the bond market has improved somewhat and new issues brought out under good auspices have been readily absorbed. As an example an offering of $15,000,000 bonds on a consolidation of Swedish match factories was almost instantly taken.

> "Meantime our home trade is entirely satisfactory. There are some who insist that after the holidays it will be smaller, but neither the markets nor the statistics sustain their predictions. The price changes recorded are neither important nor significant. . . . In Europe, the paper dollar is preferred to the gold dollar because all the foreign governments prohibit the export of gold."

Transactions like this involving the export of American capital in the form of goods are an anti-toxin that will make this country immune to the economic disorder that exists in Europe. The bankers who handle them are therefore performing a real public service as are the other banking concerns who have arranged the large credits with which the foreigners who have exported our cotton have been financed.

These credits, which have not been advertised, are in effect revolving credits which run into hundreds of millions. They partially explain our continued ability to sell our goods to an impecunious Europe and we will probably keep on shipping as long as such credits are available and are repaid as the merchandise financed goes into consumption. For this reason we need not fear the disorganization abroad if the people there can be kept at work and markets can be found for what they produce or fabricate. With political tranquility this will be possible.

The liberals among the English statesmen see this and are willing to accept inflation as the lesser of two evils. If it is resorted to there will probably be a revival of British trade for a time by which we will be indirectly benefited.

Meantime our home trade is entirely satisfactory. There are some who insist that after the holidays it will be smaller, but neither the markets nor the statistics sustain their predictions.

The price changes recorded are neither important nor significant. Wheat is a shade higher. Corn is a shade lower and cotton has reached and passed 30 cents upon the fear that the crop estimate to be issued Nov. 2 will indicate a sensational reduction in the productive expectancy.

On the mathematical relationship of the prospective crop and consumption very much higher prices for cotton may be logical, but the trees never grow to the skies and the psychological factor should not be ignored. It has and it may again interfere with the law of supply and demand.

The same generalization may apply to wool and woolen goods. Higher prices are statistically indicated but retail dealers say that buyers of all sorts of dry goods are commencing to consider cost very carefully.

As to most other commodities, there is nothing new to say. Business seems to be on an even keel. Sentiment would be improved by a settlement of the disorder in Europe, but in an economic sense this country has become so self-contained that the essentials of our domestic prosperity are no longer much affected by conditions abroad.

This view is confirmed by the weekly statement of the Federal Reserve System which shows a gain of $11,000,000 in the gold held and a reserve ratio of 76.8. In so far as our supplies of credit and cash are concerned our position is invulnerable and it is not surprising to hear that the dollar is rapidly becoming the preferred medium of exchange all over the world.

In Europe the paper dollar is preferred to the gold dollar, because all the foreign governments prohibit the export of gold. It is estimated that about $700,000,000 in American paper dollars is now in circulation outside the United States, and as the foreign currencies become worthless the demand for dollars is increased. As long as this condition persists we are not likely to lose gold and the monetary ease which prevails here seems likely to continue indefinitely.

Japanese Reconstruction Board Enlarged

The Metropolitan Reconstruction Board in Japan, which is to have charge of all reconstruction work throughout the devastated area has been enlarged and will consist of eleven members, according to a cablegram to the Department of Commerce from the commercial attaché at Tokyo.

Just How Poor Is Germany?

Many think that the rumored wealth of the industrialists has been exaggerated—The troubles of the machine tool builders and what's to be done

BY OUR BERLIN CORRESPONDENT

THE proudly commenced but ingloriously ended passive resistance in the Ruhr will forever be one of the most sinister chapters in Germany's troublous post-war experiences.

It was looked upon as an economic warfare which no doubt is quite a fitting figure of speach. The business situation resembles indeed a battleground strewn with the debris of many important strongholds. There is not the shadow of a doubt that more than four years of real war have not played such havoc with business as the barely nine months of passive resistance. Immediately at its end it does not appear as an exaggeration to speak of a more or less complete debacle.

In the light of comparison between the end of the great war and that of the economic warfare of the Ruhr which latter as a national struggle was of pygmean proportions compared with the former, many facts become clearly revealed, foremost among them the national impoverishment hidden behind an illusive hot house prosperity. The collapse of the passive resistance is attributed to the gigantic expenditure involved, which during its last week has run up to 233,000,000 gold marks not counting the indirect cost entailed by the depreciation of the currency with its disastrous effects upon the State revenue—in fact the whole national revenue. The values involved have, however, not been swept away like in the war, but in a large degree only changed hands. The true cost of the Ruhr war are constituted solely by the aggravated adversity of the foreign trade balance and loss of production. Large as they are, comparison with the cost of the war quite dwarfs them. Still they have brought business to the brink of ruin.

It is quite clear that the crisis following the Ruhr war is not its direct product but rather has matured in the unhealthy atmosphere of the years preceding it. The Ruhr war has solely precipitated its climax.

The Machine Tool Trade

The machine building industry, in fact industry as a whole enters with the end of the Ruhr war into a distinctly new phase. The era of inflation is over, killed by its excesses. The paper mark is in its last convulsions, a new currency, alleged to be of stable value is in the advent. The gold standard, although not firmly re-established yet, has made its entrance into all calculations. Values, which by gigantic inflation have assumed grotesque proportions are again reduced to their true dimensions. Many manufacturers when drawing up a gold balance, the first after almost a decade, had to realize how poor they have become. The huge profits which they made during past years appear to have vanished into thin air. Their possessions consist of their plant and their share in the 2 or 3 billion gold marks of working capital invested in foreign securities which the whole German industry is commonly credited with. Although this estimate is no doubt much too low, the single share is certainly a slender part of what it used to be. The quoted value of stock, which is supposed to represent the complete wealth of a company is in all cases of machine building works far below par.

German industrial property has in the average shrunk to the twentieth part of its pre-war value. A ratio of 1:8 as in the case of Ludwig Loewe & Co., one of Germany's leading machine tool works, is purely exceptional. There are only an elect few in the German machine building industry that can boast of such comparatively small depreciation of stock value. Their capital has never been increased and their assets constitute wealth accumulated in many years of conservative financial policy. Although industrial stock is, generally speaking doubtless under-valuated as regards capital value, the quotations represent as a rule the relation of present and pre-war liquid means. Although this relation has played a comparatively unimportant part during the era of inflation it weighs, of course, heavily at a return to the gold standard.

> "It would be an exaggeration to speak of a financial calamity, but a crippled state of finances certainly exists. This becomes apparent whenever the question of a return to pre-war trade terms is taken under discussion, a subject which will certainly become imperative as soon as there is a stable currency. Manufacturers have not up until now been required to face this question, having usually received part payment in advance and the rest upon delivery."

It would be an exaggeration to speak of a financial calamity, but a crippled state of finances certainly exists. This becomes apparent whenever the question of a return to pre-war trade terms is taken under discussion, a subject which will certainly become imperative as soon as there is a stable currency. Manufacturers have not up until now been required to face this question, having usually received part payment in advance and the rest at delivery. This was part of the bargain which their products were supposed to represent. It may safely be said that most manufacturers would find it now exceedingly hard not to say impossible to grant pre-war terms of payment. The buyer had to provide the working capital for the manufacture of his purchases.

Miss the Advances

The manufacturer received his money several months sooner than in pre-war times. The sums which used to be fed into the manufacturing process during those months are now missing in the majority of cases.

Not all are financially strong enough to work for stock and none to carry stock of a pre-war size. Such conditions were bound to come to an end one day. The Ruhr war has precipitated this development. To restore the financial equilibrium in industry's household, large credits are required which are clearly beyond the strength of the German banks. The manufacturers must resort to foreign loans, a fact corroborated by past experience. The trend of future developments is outlined quite clearly. Alienation of industry's capital, already noticeable everywhere will doubtless take still larger dimensions. Firms however, which are outside the pale of foreign interest, chiefly the younger or weaker members, also most private companies, are threatened with financial breakdown.

Can They Compete?

Apart from financial conditions the most important problem is: will the industry in the future be able to compete on foreign markets? The domestic market is much too small for the capacity of the industry. It could, at its best, hardly keep more than half of it employed. The other half, and the possibility to expand, can be found in the export business only.

The opinions heard in manufacturing circles in reply to this question are distinctly in the negative. This is not surprising, at this juncture seeing the upheaval of the fundamental conditions upon which their business had rested. It cannot, however, be answered definitely before the promised stable currency is firmly established and conditions had time to adjust themselves to it. There are certain elements in the cost problem, which manufacturers have it in their power to improve by more economical management and others which will rectify themselves automatically on the basis of a stable currency. Present prices of supply bear all the hall marks of excessive inflation. They are themselves inflated by safety factors incorporated in them as a consequence of their constantly shifting basic components. The manufacturer does not know his cost of labor until wages are due and not even then, as he regularly is faced by after-claims. Further he does not know how many paper marks he will realize from export proceeds and what intrinsic value the paper marks received from domestic sales really represent. This state of affairs, entraining an ever increasing and perfectly arbitrary safety co-efficient in all price calculations has to a large degree been responsible for the violent movement of prices, which quickly imparted itself to wages and has strongly precipitated the degeneracy of the paper mark.

It must be assumed that a stable currency will eliminate such co-efficients and reduce prices to their true size. The one factor which manufacturers have not in their power to remedy is the labor problem, comprising also the various encumbrances imposed upon them by socialistic labor legislation and

a hypertrophical administration machinery.

It is quite a dogma amongst manufacturers that in an era of stable currency the industry cannot exist unless pre-war conditions of labor are restored. They argue that the profits they have made during past years were mostly on paper only. That they were also chiefly of the so-called "invisible" kind resulting not so much from an honest surplus, but from the clever handling of overdrafts incurred at a certain mark rate and settled at a much lower one is now generally realized.

During the last months of the Ruhr-war and for some considerable time after its end, the German machine building industry, in fact business life as a whole, must be viewed as in a state of transition. Apart from economical problems momentous political questions are in suspense, foremost among them the future political status of the Rhineland and Ruhr. A customs cordon separating them from the German interior would seriously aggravate the future situation of the industry, narrowing the domestic market of either side and cutting deep into the usual ways of supply. The system of so-called "index" wages keyed to the cost of living is clearly untenable.

More Taxes

Hastily contrived taxation like the newly introduced—"work tax" imposed upon manufacturers at the rate of 20 per cent of all wages and salaries is overwhelming industry with added difficulties. Sudden contraction and ruinous rates of credits are putting the finishing touch on the situation. It can plainly be seen that the weaker members cannot sustain the strain and are at the point of breakdown. For the rest a waiting policy at closest retrenchment is adopted. Unemployment had in September not yet assumed exceptional dimensions. The number of unemployed of the machine building industry has from 3.6 per cent at the beginning of August risen to 7 per cent at the eighth of September, that of short time workers from 15.9 per cent to 25.3 per cent.

The works are kept going on old orders, new ones have become exceedingly scarce. The volume of business in hand is dwindling down through cancellations. A perfect avalanche of unemployment is, however, preparing itself under the surface as is indicated by the appalling number of factories which have given notice of shutting down under existing regulations which stipulate that this measure is carried out in stages covering about two months. It must be expected to commence its motion in October, an event which is looked forward to with a good deal of anxiety. In Saxony nearly one-half of all existing works are involved in it. The only gleam of light is seen in the lifting of the export control which is now restricted to certain classes of raw and semi-finished material. Machinery export is freed from all fetters. Not that this will help much to revive business. It might only be useful in speeding up shipments and especially in assisting the manufacturers in the occupied parts to clear their large stock, accumulated during the Ruhr blockade. The chief value of the measure is seen in its symptomatical nature, as a start in the right direction and a herald of free business.

Dr. Steinmetz Dies Suddenly

Dr. Charles Proteus Steinmetz, chief consulting engineer of the General Electric Co., died at Schenectady on Oct. 26, after a very brief illness. Dr. Steinmetz was taken sick during his recent visit to the West and although he recovered sufficiently to make the return trip to the East, the attack of illness which he suffered in the West proved fatal because of the patient's lowered resistance.

Dr. Steinmetz was an engineer-scientist whose gifted genius was widely

CHARLES P. STEINMETZ

reflected in electrical and chemical experimentation, research and design. His ability was recognized everywhere, and on old and new problems alike his opinions were eagerly sought. His most constructive work was done, perhaps, in connection with the development of alternating current motors, generators, converters, regulators, lighting and the like. His contributions to the advancement of electrical science and indirectly to humanity will probably never be fully appraised.

His Early Life

Dr. Steinmetz was born April 9, 1865, at Breslau, Germany. He was educated at the Breslau gymnasium and university, studying mathematics, astronomy, physics, chemistry and other branches including economics. In Switzerland he studied mechanical engineering at the Polytechnicum of Zurich. In 1889 he came to America and secured a position with the Eickemeyer Manufacturing Co. first as draftsman then as electrical engineer and designer, and finally on research work in charge of the Eickemeyer laboratory. With the absorption of the Eickemeyer interests by the General Electric Co., Dr. Steinmetz was attached to H. F. Parshall's calculating department in Lynn, Mass. When the company's headquarters were transferred to Schenectady, N. Y., in the spring of 1894, he organized and took charge of the calculation and design of the company's apparatus and of the research and development work. Since 1902 he has been professor of Electrical Engineering at Union University, at the same time retaining his connection with the General Electric Co. as consulting engineer, organizing and assuming charge of its consulting electrical department in 1911.

Dr. Steinmetz was a fellow of the American Association for the Advancement of Science, a member of the Mathematical Society and of the Physical Society. He was a past president and member of the American Institute of Electrical Engineers. He was the author of more than a score of books and of numerous papers on scientific and electrical subjects, many published in the Transactions of the American Institute of Electrical Engineers.

Barnes Optimistic on Export Future

Large scale production, attention to quality, and the inventive spirit of American manufacturers are bound to force the development of American export trade even against the lower competitive labor costs in foreign countries, said Julius H. Barnes, president of the Chamber of Commerce of the United States in an address before the National Foreign Trade Council of the American Manufacturers' Export Association at its annual luncheon at the Waldorf-Astoria Hotel on Oct. 25.

"You may be sure," said Mr. Barnes, "that the test of competitive labor costs in other countries will never be more severe than this last five-year period which you have successfully surmounted. The power of foreign industry to purchase labor service on a traditional currency name, no longer inherently possessed of its real measure of value, has almost run its course. When bread in Berlin sells, a single loaf at 2,500,000,000 marks, we know the long road of labor payment, unconsciously accepting the traditional mark with something of its historical purchasing power, is rapidly drawing to a close.

"There comes a time in these fantastic currencies of the world, when, robbed of this misleading tradition of value inherent in the name itself, these currencies under some title and in some relation must be stabilized in wage payment, in some fair relation to the things of ordinary worker requirement, to food and clothes, and shelter."

E. P. Thomas, president of the United States Steel Products Co., presided at the luncheon.

Baltimore Safety Board Will Start Meetings

The Industrial Safety Conference Committee of the Baltimore Safety Council, Baltimore, organized to seek co-operation in safety work in all the industrial plants of the city, has been organized with George W. Knapp, Jr., factory manager of the National Enameling & Stamping Co., Baltimore, as chairman. Within a few weeks the committee will start meetings for superintendents, foremen, safety engineers and others connected with the plants with the view of organizing safety councils in each plant. Prominent speakers on safety will address the meetings.

Personals

EDWARD G. SCHULTZ, treasurer of the R. K. LeBlond Machine Tool Co., Cincinnati, has been appointed receiver of the Cincinnati Aluminum Casting Co., Norwood, Ohio.

A. J. BARNES has charge of the New York office of the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. His headquarters are at 30 Church St.

H. C. POOLE, formerly sales manager in the New York office for the Colonial Steel Co., Pittsburgh, has been made general works manager.

C. J. FRANKLIN is in charge of the Western office of the Moltrup Steel Products Co., Beaver Falls, Pa. His headquarters are at 421 Stark St., Portland, Ore.

H. W. GLEDHILL, Eastern sales manager for the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., will open offices in the City Centre Building, 121 N. Broad St., Philadelphia.

COL. JOHN ROSS DELAFIELD has been appointed to the rank of Brigadier-General by the Secretary of War. Gen. Delafield will have charge of the Ordnance Officers' Reserve Corps.

W. W. PHILLIPS, for the past twelve years sales representative for the Colonial Steel Co., Pittsburgh, in the Rochester district, has been made sales manager in charge of the New York office, with headquarters at 149 Varick St.

GEORGE HESSE has charge of the Pittsburgh office as district manager for the Blacker Engineering Co., New York. The Pittsburgh office is located at 421 Wood St.

G. K. ATKINSON, formerly connected with the Langhaar Ball Bearing Co., Aurora, Ind., is now connected with the New Britain Machine Co., New Britain, Conn., in the capacity of sales representative in the state of Ohio. His headquarters will be in Cleveland.

CHARLES P. TOLMAN has resigned as chief engineer and chairman of the manufacturing committee of the National Lead Co., New York, and has opened offices as consulting engineer. His headquarters will be at 111 Broadway.

F. E. HARRISON is the New York representative for the Eclipse Counterbore Co., Detroit, Mich. His headquarters are at 56 Pine St.

R. P. MCCORMICK, formerly with the Austin Machinery Corp., has been appointed Eastern sales manager of the Pawling & Harnischfeger Co., Milwaukee, with his offices at 50 Church St.

H. A. BAUGH, formerly a salesman with the Shepard Electric Crane & Hoist Co., has been appointed sales manager in the Pittsburgh district.

A. C. SMITH has arrived in Wallingford, Conn., from Houdon, France, where he has established a permanent residence. He will engage in manufacturing in Houdon and is in this country to purchase machinery for a plant he will set up to produce boring bits. Production of 1,500 bits daily is the opening schedule.

ALBERT W. GRAY, works manager for the past three and a half years at the Billings & Spencer Co., Hartford, Conn., has become works manager for the Bristol Brass Co., Bristol, Conn., succeeding JOHN F. WADE, who will take charge of the brass company's real estate.

N. P. FARRAR has resigned as district manager at Pittsburgh for the Shepard Electric Crane & Hoist Co. and has joined the sales staff at the Philadelphia office of the Pawling & Harnischfeger Co., Milwaukee.

PAUL T. WARNER, of the Baldwin Locomotive Works, addressed the Washington section of the American Society of Mechanical Engineers on Oct. 26. His subject was "The Locomotive as a Self-Propelled Power Plant."

FRANK CASPER WAGNER, for the last twenty-eight years a professor of engineering at Rose Polytechnic Institute, Terre Haute, Ind., and acting president since the resignation of DR. PHILIP B. WOODWORTH last May, has been elected president of the school by the board of managers.

L. M. KLINEDINST, assistant manager of sales, has been in addition, appointed advertising manager of the Timken Roller Bearing Co., Canton, Ohio. He succeeds R. E. MACKENZIE, who has resigned after four years' service.

Obituary

WILLIAM COPPEDGE HICKS, of Charlotte, N. C., district sales manager in the Southeastern territory for the Globe Automatic Sprinkler Co., of Philadelphia, died the latter part of October at Raleigh, N. C., following a stroke of apoplexy. He was 42 years of age, and had been in ill health for some time.

JOHN P. ARMSTRONG, president of R. S. Armstrong & Bro., Atlanta, Ga., one of the largest dealers in used machinery and used machine tools in the Southeast, and a pioneer in the industry in the Southern field, died the latter part of October at his home, 381 Williams St., at the age of 66 years, after a long period of illness. Mr. Armstrong had been a resident of Atlanta for a period of thirty-nine years, coming to the city from Albany, N. Y., in 1884, at which time he established, with his brother, the machinery, tool and iron firm of R. S. Armstrong & Bro., assuming the presidency of the concern and remaining as its executive head to the time of his death.

CHAS. C. JENKS, president of the Security Trust Co. and the Jenks & Muir Manufacturing Co., died in Richmond, Va., while on his way from the South to his home in Detroit. He was actively connected with the iron and steel trade in Detroit, having occupied a prominent position with the Peninsular Car Co. At one time he occupied the chief executive position in the United States Radiator Co., and at the time of his death was a director and member of the executive committee of Detroit-Edison Co., the Maxwell Motor Corp., the Detroit Lubricator Co., as well as many financial institutions of the city.

JAMES J. HAY, superintendent of the Vermont Farm Machine Co., Bellows Falls, Vt., died by electrocution in his bathroom Oct. 19, due to a defective lighting fixture. He had served the company as superintendent for 15 years.

WILLIS L. BROWN, SR., secretary and general manager of the Belvidere Screw & Machine Co., Belvidere, Ill., died recently.

Business Items

The Indian Motorcycle Co. is the name adopted in place of the Hendee Mfg. Co., by vote of the stockholders and directors in Springfield, Mass., Oct. 24. Frank J. Weschler was re-elected president, William E. Gilbert, vice-president and Parmly Hanford, treasurer.

The American Saw & Manufacturing Co., producer of hack and band saw blades, Springfield, Mass., has acquired the Dolman Manufacturing Co. of that city and will merge that concern's business of producing screwdrivers with its own establishment, which is being enlarged for the purpose.

The Mack Manufacturing Co. will move its automobile signal plant to Escanaba, Mich., in the Upper Peninsula, it is reported here.

The factory of the Charles Schaible Co., brass manufacturer and the brass foundry of the Berger Manufacturing Co., Cincinnati, were damaged by fire recently. The damage to the two plants was estimated at $6,000.

Property of the Stroh Casting Co., Detroit, for which the Secrurity Trust Co. is receiver, will be sold at auction at the company's plant on Nov. 2, under an order issued by Judge Ormond F. Hunt of the Circuit Court. The receiver has been in possession of the property since April of this year and for a time operated the business which was principally the manufacture of household aluminum ware.

The Coosa Pipe & Foundry Co., of Gadsden, Ala., announced the awarding of a contract for the construction of a new $75,000 plant to replace the company's present plant at Gadsden, The new factory will be considerably larger, increasing capacity about 20 per cent, and will include considerable new equipment and a steel cupola room.

A plant for the manufacture of motors and engines for marine use has been acquired at Brunswick, Ga., by the Everett Brothers Motor Co., a new corporation recently formed, and following improvements the new company will operate the plant manufacturing a new marine motor and other equipment recently perfected, it has been announced by Thomas R. Everett, of Athens, Ga., president of the company.

Conferences have begun between W. T. Durbin, of Anderson, Ind., as receiver for the Anderson Foundry & Machine Co., one of the Dollings subsidiaries, and Bert McBride, receiver for the R. L. Dollings Co. of Indiana, in regard to reorganization plans for that company.

The Cadillac Machinery Co., Detroit, has been appointed exclusive agent for the Grand Rapids Grinding Machine division of the Gallmeyer & Livingston Co., Grand Rapids, Mich., to cover the Detroit district and eastern Michigan.

The Cochise Machine Co., Los Angeles, Calif., has changed its name to the Cochise Rock Drill Manufacturing Co.

The United Tool & Die Co., of Hartford, Conn., has incorporated with an authorized capitalization of $50,000 of which $25,000 is paid in. James J. Carney of No. 17 Kelsey St., Hartford; Joseph E. Delaney, No. 30 Darcy St., West Hartford and Frank R. Velhage, No. 53 Levesque St., West Hartford are the incorporators.

The P.G. S. Co., Inc., of New Haven, Conn., has incorporated with a capital of $350,000 of which $250,000 is paid in. Arthur W. Chambers, Helen H. Hitchcock and Elizabeth M. Kraus, all of New Haven are the incorporators. Automobile parts and mechanical articles are listed as products.

Herbert F. Johnson, trustee of the Mitchell Motors Co., Inc., Racine, Wis., bankrupt, has instructed his representative, H. J. Weber, to immediately offer for sale the entire remaining shop equipment singly or in parcels. The equipment consists of an exceptionally wide variety of machine tools, hammers, presses, pots, ovens, woodworking machinery, etc., with more than 5,000 items listed. Later the real estate and buildings will be offered for sale. This method of liquidation was made necessary by the absence of a satisfactory bid for the plant and equipment as a whole.

The Evansville Tool Works, Inc., Evansville, Ind., with a capital of $200,000 preferred and $10,000 common no par value, has been incorporated to manufacture tools. The directors of the company are Samuel L. Orr, Irving S. Kemp, Caselberry Dunkerson, Frank Lohoff and Samuel Tweedal.

The American Metal Products Co., Thirty-third Ave. and Burnham St., Milwaukee, bronze castings, has decided to add a complete rolling mill and is now erecting an addition, 70x120 ft. When completed, this department will roll plates and bars from brass and copper as well as bronze. The company has purchased from the Briggs & Turivas Co., Joliet, Ill., a 5-stand, three-high 12-in. bar mill and a three-stand two-high plate mill, made by the Lewis Foundry & Machine Co., and a 400 hp. General Electric motor. Purchases of other machinery are now being made. The company is inquiring for a cropping shear, a squaring shear and a roll lathe taking work up to 72 in. in length and 22 in. diameter.

The Mine & Mill Supply Co., distributor in the Southern field of mine and milling supplies, etc., has moved its main headquarters to Lakeland, Fla., where it is planned to establish a plant and main offices, the company to construct a new building there on West Lemon St. Capital was recently increased from $100,000 to $200,000. Officers are now maintained at Mulberry, Fla., Tampa, Fla., and at Savannah, Ga., in addition to the headquarters office at Lakeland.

Francis Fenwick Is Claimed by Death

Francis Fenwick, the head of Fenwick Freres et Cie., well known Paris agents for a large number of American machine tool concerns, died at his home in Croissy-sur-Seine near Paris on Friday, Sept. 21, at the age of seventy-three. He was born in Paris on April 18, 1851, the eldest son of an English father and a French mother. The history of his life is largely the history of the business to which he devoted all his life.

The business was founded by his

FRANCIS FENWICK

father and mother in 1862, and from the first, and for a great many years, was devoted solely to commission undertakings for American and other foreign buyers. In 1885 Francis Fenwick became associated with his parents and brother, and later in 1888, on the death of his father, became the head of the firm, now called Fenwick Freres et Cie. During all these years, he made frequent trips to America where he was favorably known to numerous merchants in our leading cities who were accustomed to buy articles of European manufacture.

The entrance of the then firm into the business of representing American manufacturers of machine tools grew out of a close friendship with the late Lucian Sharpe, one of the founders of the Brown & Sharpe Mfg. Co. In 1888, on bidding farewell to Mr. Sharpe in Providence, he casually inquired if Mr. Sharpe had anything which he could sell in France. To this Mr. Sharpe replied that he might be able to dispose of some hair clippers, and provided him with samples.

During the following year, 1889, occurred the Paris Exposition, at which the company had an exhibit of considerable importance, over which presided F. G. Kreutzberger, lately retired as director of the well known Arsenal of Peuteaux, a man of splendid mechanical ability and experience. Following the Exposition, it was only natural that Mr. Kreutzberger's mechanical abilities should be seconded by the Fenwick interests, which had begun to represent the Providence concern; so between them they took the agency for selling machine tools in France and neighboring countries. Mr. Kreutzberger, however, soon retired as his age was not equal to the responsibilities, and Fenwick Freres et Cie. became the sole representative. Becoming incorporated as the Societe Anonyme des Etablisement Fenwick Freres et Cie., the house took the agency for various American concerns, and through ensuing years assumed the representation of many others. The expansion of this business later necessitated removal to more commodities quarters, which were built for the purpose at 8 Rue de Rocroy the present location.

In 1908 he was decorated by the Government as Chevalier of the Legion d'Honneur. Later he was made president of the Chambre Syndicale des Importateurs Francais; fostered by the Government, according to its custom, which body was to prove so useful in the War. He was also vice-president of the Comptoir d'Achats des Machines-Outils and a member of the Comité Interministeriel des Machines-Outils and d'Outillage Mechanique at the War Department. These various positions were only a small indication of the esteem in which he was held in France.

Interest Is Shown in Representation Plan

An information bulletin of the Pennsylvania R.R. states that the vote polled in the recent elections by shop employees of the Pennsylvania Railroad System for representatives on the various Shop Craft committees, indicates that more than 85 per cent of all the shop employees have signified by secret ballot their approval of the Pennsylvania plan of employee representation for the settlement of disputes that may arise between the men and the management.

A final report of the elections held this year in the four operating regions and Altoona Works shows that 85.9 per cent of all the shopmen of the entire system voted in these elections.

It will be recalled that the controversy between the United States Railroad Labor Board and the Pennsylvania R.R. grew out of the first elections of employee representatives of the shop crafts. The management believes that the results of this year's elections, which have now been completed, removes any reasonable doubt that might have existed as to the real desires of the Pennsylvania shopmen.

Forthcoming Meetings

American Society of Mechanical Engineers. Annual meeting, Dec. 3 to 6, in New York City. Calvin W. Rice, 29 W. 39th St., New York City, secretary.

National Exposition of Power and Mechanical Engineering. Second annual exposition to be held at the Grand Central Palace, New York City, Dec. 3 to 8. Headquarters, Grand Central Palace, New York City.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Imported pig iron again appearing in the market. Price of coke low; furnace grade down 25@50c. per ton at Connellsville. October steel demand showed improvement over preceding month. Steel pipe, sheets, tin plate and nails most active items in present market. Plates and shapes still at $2.50 base; bars, $2.40 per 100 lb., with no quotations under that figure. Railroad and ship plates form bulk of steel plate demand; structural material quiet.

Advances—Tin shows sharp advance due to increased domestic demand; up 1¼c. per lb. in week. Antimony market stiffened appreciably; rose ½c. per lb. in New York.

Declines—Copper (electrolytic) at lowest price level since September, 1921; down ½c. per lb. in week. Increased discounts offered on bolts, nuts and rivets in Cleveland warehouses during week.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$26. 05
Northern Basic	25. 00
Southern Ohio No. 2	25. 00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2. 25@2. 75)	29. 00
BIRMINGHAM	
No. 2 Foundry	23. 00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2. 25@2. 75)	24. 25
Virginia No. 2	28. 17
Basic	25. 00
Grey Forge	25. 00
CHICAGO	
No. 2 Foundry local	25. 50
No. 2 Foundry, Southern (silicon 2. 25@2. 75)	28. 00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26. 77
Basic	26. 77
Bessemer	27. 77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4. 75
Cleveland	6. 75@7. 40
Cincinnati	7. 50
New York	5. 50@7. 00
Chicago	5. 25@5. 75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3. 00	4. 59	3. 75	4. 15
No. 12	3. 10	4. 64	3. 80	4. 20
No. 14	3. 20	4. 69	3. 85	4. 25
No. 16	3. 40	4. 79	3. 95	4. 35
Black				
Nos. 17 and 21	3. 70	4. 95	4. 45	5. 05
Nos. 22 and 24	3. 75	5. 00	4. 50	5. 05
Nos. 25 and 26	3. 80	5. 05	4. 55	5. 10
No. 28	3. 85	5. 15	4. 65	5. 20
Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	4. 00	5. 15	4. 70	5. 35
Nos. 12 and 14	4. 10	5. 25	4. 80	5. 45
Nos. 17 and 21	4. 40	5. 55	5. 10	5. 75
Nos. 22 and 24	4. 55	5. 70	5. 25	5. 90
No. 26	4. 70	5. 85	5. 50	6. 05
No. 28	5. 00	6. 15	5. 80	6. 35

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0,17 lb. to 0. 36 lb. per ft. Cutting charge per 100 cuts, $1. 50 to $1. 58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0. 09	50%	⅞	$0. 16	35%
⅝	. 11	45%	1	. 18	31%
¾	. 14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4. 50	6. 00	4. 50
Spring steel (light) (base)	7. 00	6. 00	6. 00
Coppered Bessemer rods (base)	6. 53	8. 00	6. 55
Hoop steel	5. 19	4. 66	4. 55
Cold rolled strip steel	7. 50	8. 25	7. 25
Floor plates	5. 80	5. 66	5. 80
Cold drawn shafting or screw	4. 65	3. 90	4. 55
Cold drawn flats, squares	5. 15	4. 40	5. 05
Structural shapes (base)	3. 64	3. 46	3. 40
Soft steel bars (base)	3. 54	3. 36	3. 20
Soft steel bar shapes (base)	3. 54	3. 36	3. 20
Soft steel bands (base)	4. 39	3. 61	3. 95
Tank plates (base)	3. 64	3. 46	3. 30
Bar iron (3. 25 at mill)	3. 54	3. 36	3. 20
Tool steel	11. 00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7. 35c. per lb.

METALS

Current Prices in Cents Per Pound			
Copper, electrolytic (up to carlots), New York			13. 12½
Tin, 5-ton lots, New York			43. 50
Lead (up to carlots), St. Louis	6. 55	New York	7. 22½
Zinc (up to carlots), St. Louis	6. 30	New York	6. 75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25. 50	27. 00	25. 50
Antimony (Chinese), ton spot	9. 00	10. 50	7. 50
Copper sheets, base	21. 25	21. 50	23. 00
Copper wire, base	15. 50	18. 75	16. 25
Copper bars, base	19. 75	22. 00	19. 50
Copper tubing, base	24. 00	27. 00	23. 00
Brass sheets, base	17. 50	21. 75	18. 75
Brass tubing, base	22. 50	27. 00	20. 50
Brass rods, base	15. 25	17. 75	15. 75
Brass wire, base	18. 00	21. 75	....
Zinc sheets (casks)	10. 25	10. 45	....
Solder (⅓ and ½), (case lots)	29. 50	29. 00	24. 00
Babbitt metal (83% tin)	52. 00	52. 00	40@42
Babbitt metal (35% tin)	25. 00	17. 50	17@20
Nickel (ingot and shot)	29. 00	....	....
Nickel (electrolytic)	32. 00	....	35. 00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57. 00
Hot rolled rods, Grade "A" (base)	55. 00
Cold drawn rods, Grade "A" (base)	63. 00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.50	11.50
Copper, heavy, and wire	10.75	11.00	10.75
Copper, light, and bottoms	9.50	9.00	9.75
Lead, heavy	5.75	5.25	5.90
Lead, tea	4.75	4.00	5.00
Brass, heavy, yellow	7.00		7.00
Brass, heavy, red	8.75	9.25	8.75
Brass, light	6.25	5.00	6.25
No. 1 yellow brass turnings	7.00	5.75	7.00
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13¼x13¼, per lb	11.00	36.00 per M	.10
Wiping cloths, 13¼x20½, per lb.		52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.98	1.05	1.14
Lard cutting oil (50 gal. bbl.) per gal	.55	.50	.67½
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.297	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5–2½	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville		per net ton	3.50@4.00
Coke, prompt foundry, Connellsville		per net ton	5.00@5.50
White lead, dry or in oil	100 lb. kegs	New York, 14.00	
Red lead, dry	100 lb. kegs	New York, 14.00	
Red lead, in oil	100 lb. kegs	New York, 15.50	

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.0465	0.0465	0.039
Brass rods	per lb.	0.1525	0.1575	0.17
Solder (½ and ½)	per lb.	0.295	0.295	0.265
Cotton waste	per lb.	.10@.13	.10@.13	.09@.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.55
Machine oil	per gal.	0.297	0.297	0.33
Belting, leather, medium	off list	30–10%	30–10%	40–5%
Machine bolts up to 1x30 in.	off list	40–10%	40–10%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40–10%	60%	45–5%
1⅛ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	25–10%	$3.50 net	
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30–10%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	
Hex. head and hex. nut bolts	List net		65–5%
Lag screws, coach screws	40–10%		60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	30–10%	50%	40–5%
Bolt ends, with hot pressed nuts	40–10%		55%
Tap bolts, hex. head, list plus	35%		
Semi-finished nuts, 5/16 and smaller	60%		
Semi-finished nuts, ⅜ and larger	55%	70%	80%
Case-hardened nuts	40%		
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, hex., per 100 lb. Off list	0.50	3.50	2.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50–10%	60%	60%
Rivets, tinned	50–10%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.60	$3.75
Cone heads, ditto (net)	5.60	3.80	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25		0.15
⅝ in. diameter *EXTRA*	0.15		0.15
½ in. diameter *EXTRA*	0.50		0.50
1 in. long, and shorter *EXTRA*	0.50		0.50
Longer than 5 in. *EXTRA*	0.25		0.25
Less than 200 lb. *EXTRA*	0.50		0.50
Countersunk heads *EXTRA*	0.35		$3.70 base

New and Enlarged Shops

Machine Tools Wanted

Ala., Tuscaloosa—Yellow Cab Co., Broad St.—drill press and lathe.

Conn., Hartford—Long Bros., State St.—lathe, planer, shears, upright drill, hack-saw, bolt threading machine and small tools for proposed garage.

D. C., Wash.—Dist. Comrs.—receiving bids until Nov. 5 for a 12 in. x 5 ft. geared head light duty engine lathe.

Fla., Sandford—H. F. Kent, Commercial and Rand Sts.—lathe, drill press and bench tools for garage.

Fla., Tampa—Hulsey & Holtsinger, Marion and Lafayette Sts.—drill press and lathe for automobile service station.

Ill., Chicago—Illinois Central R.R., 135 East 11th Pl., J. J. Bennett, Purch. Agt.—75 ton vertical motor driven hydraulic press.

Ill., Chicago—E. J. Paidar Co., 1218 North Wells St.—No. 3 punch press; 21 in. or over, turret lathe with power cross and longitudinal feeds; high speed saw with pump.

Ill., Rockford—Reliable Machine Co., 1324 10th Ave.—20 in. drill press.

Kan., Lawrence—G. W. Savage, 602 New Hampshire St. (machine shop)—36 in. x 10 ft. lathe, reamer and small hand tools.

Mass., Boston — Grovehall Realty Trust Co., c/o E. P. Finn, 1 Beacon St.—machinist's tools, including lathe, drills, etc., for proposed $250,000 garage.

Mass., Worcester—Crompton & Knowles Loom Wks., 93 Grand St., address Purchasing Dept.—machine tools for addition to factory.

Mich., Detroit—Kroger Grocery & Baking Co., 4760 Merritt Ave.—equipment for repair department of proposed $90,000 garage.

Mich., Kalamazoo—Valley Paper Co., 401 Press Bldg.—high speed motor driven paper machine, beaters, also complete machinery and tools for small machine shop.

Mo., Joplin—W. R. Watson, Genl. Delivery—drill press, lathe, belting, hangars, emery stand, shafting and bearings for garage.

Mo., Kansas City—Acme Electric Co., 2121 East 39th St.—7 ton punch press.

Mo., St. Louis—Tate Motor Co., Garrison Ave. and Washington Blvd.—drill press and lathe.

N. Y., Buffalo—Buffalo House Wrecking Salvage Co., 477 Walden Ave.—equipment, also one 1,000 gal gasoline tank and pump for service station on Main and Custer Sts.

N. Y., Buffalo—J. A. Cramer, 1010 Main St.—equipment for automobile service station at 173 North Pearl St.

N. Y., Buffalo—A. Diclanni, 415 Niagara St.—equipment for garage and repair shop.

N. Y., Buffalo—E. Goodman, 719 Genesee St.—equipment for automobile repair shop at 169 Niagara St.

N. Y., Buffalo—J. Strootman, 657 Genesee St.—repair shop tools and equipment for garage.

N. Y., New York—New York Mchy. Co., 200 5th Ave.—pipe threading and cutting machine.

N. Y., Niagara Falls—N. Marcelle, 516 Walnut St.—garage and repair shop equipment and tools.

N. Y., Olean—Terry Chevrolet Corp., L. S. Terry, Purch. Agt.—tools, drill presses and equipment for garage.

N. Y., Rochester—L. G. Gibaud, 352 Main St., E.—machine shop and automobile service tools, machinery and equipment.

N. Y., Rochester—G. Higgins, 38 South Fitzhugh St.—garage tools, machinery, drill presses and equipment for repair shop.

O., Cincinnati—Cincinnati Planer Co., South St., Oakley—30 to 48 in. open side planer and 48 to 72 in. boring mill.

O., Columbus—C. A. S. Products Co., Box 84—automatic screw machine.

O., Fremont—East Side Implement Co., E. Winters, Purch. Agt.—tools and equipment for automobile repair shop.

O., Youngstown—Trucson Steel Co., Albert Extension, J. Kahn, Pres.—machinery and equipment for plant extension.

Okla., Picher—F. P. Ussery—drill press, emery stand and wheel for blacksmith shop.

Pa., Bellwood—Natl. Steel Constr. Co., Inc., R. I. Motysek, Supt.—one bolt re-threading machine and one semi-automatic electric welding machine, 150 volt, 22 ampere.

Pa., East Pittsburgh — Westinghouse Electric & Mfg. Co.—planers, drill presses and other machine tools, about 52.

Pa., New Castle—Pennsylvania Eng. Wks. (fabricating)—scarfing machine, plate planer, sectional flanging press, serpentine shear, straightening rolls, rotary shear and vertical punch.

Pa., Pittsburgh—J. Cutrara, 5511 Walnut St.—tools, presses and equipment for automobile repair shop.

Pa., Pittsburgh—Dorsey Garage & Repair Shop, 6115 Kirkwood St.—garage and repair shop equipment.

Pa., Pittsburgh—M. Jaconette, 6111 Kirkwood St.—automobile repair shop equipment, including bench tools and drill presses, to replace that which was destroyed by fire.

Pa., Pittsburgh—N. Joy, Music Alley and Hill St.—garage tools, presses and equipment for repair shop.

Pa., Pittsburgh—F. L. McShane, 2350 Baldwin Rd.—emery wheel, drill press, tools and equipment for automobile repair shop.

Pa., State College—Blue & White Garage, H. M. Myers, Purch. Agt.—bench tools, presses and equipment for repair department.

Pa., Westfield—V. Borden—presses, small lathe and tools for new automobile repair shop.

Pa., Wilkes-Barre—J. Edwards, 118 Waller St.—press, tools and equipment for garage.

Pa., Wilkes-Barre—J. Fox, Lee Park—drill press, small garage tools and general repair equipment for battery and automobile service station.

Pa., Wilkes-Barre — J. Iskra, 57 West Chestnut St.—automobile repair shop tools and equipment, including drill press.

Pa., Wilkes-Barre—J. F. H. Johnson, 202 North Washington St.—garage equipment, bench tools, etc.

Tex., Houston—Southern Pacific R.R., Southern Pacific Bldg., F. W. Taylor, 65 Market St., San Francisco, Calif., Purch. Agt.—equipment for proposed $100,000 shops at Valentine.

Va., Richmond — C. F. Nicholsen, 303 North Graham St.—drill press, electric hand hammer and gas soldering machine for automobile repairs.

Va., Richmond—Richmond Auto Service Co., 814 West Broad St.—medium size lathe.

W. Va., Charleston — Sterling Gasoline Corp., Winchester and 27th Sts.—drill press and lathe.

W. Va., Montgomery—Montgomery Oldsmobile Co.—lathe and drill press.

Wis., Biron (Grand Rapids P. O.)—Consolidated Water Power Paper Co.—equipment for proposed $40,000 machine shop.

Wis., Hurley—Noeman Bros.—tool room equipment and air compressor, for proposed $50,000 garage.

Wis., La Crosse—L. and S. Fee, c/o L. Fee, 1018 Denton St.—automobile repair machinery, gasoline tanks and pumps for proposed garage on Vine St.

Wis., Okauchee—Wein Bros. Co., c/o R. Wein, Mgr.—automobile repair machinery, tanks and pumps for proposed garage.

Ont., Ingersoll—T. E. Bissell Co. (manufacturer of implements)—metal working machinery, lathes, drills and special equipment for machine shops, to replace that which was destroyed by fire.

Ont., Pembroke—Desrochiers Bros., 83 Lake St.—machine shop equipment.

Ont., Renfrew—Simpson & Elliot, Argyle St., J. C. Simpson, Purch. Agt.—complete equipment for automobile repair shop.

Que., Amqui—L. Audette—drill press and small tools for garage.

Que., Charny—J. E. Malouin—drill press and lathe for garage.

Que., Lachine—J. H. Thessreault, 327 Bway—complete equipment for automobile repair shop at 48 Drummond St., Montreal.

Que., L'Islet—L. Caron—garage tools, including small lathe.

Que., Montmagny — N. Pouliott, 101 St. Jean Baptiste St.—complete service station and repair equipment.

Que., Montreal—M. Block, 207 Wellington St.—complete equipment for garage, including tank, pump and compressor.

Que., Montreal—Goddard & Appleby, 664 Union Ave.—complete equipment for automobile repair shop.

Que., Montreal—B. H. Lusher, 35 Drummond St.—complete equipment for garage and repair shop.

Que., Montreal—G. Palmer, 2 B Park Ave.—complete automobile repair shop equipment, also gasoline tank, pump and air compressor.

Que., Outremont—P. Guidazio, Apt. 1, 640 D'Epee St.—complete equipment for 90 x 167 ft. garage.

Ont., St. Isidore de Prescott—J. Longtin—lathe, etc., for garage.

Que., Ste. Marie, Beauce—J. Bilodeau—automobile repair machinery.

Que., St. Romuald d'Etchemin — J. Halle, 235 Commerciale St.—bench tools, lathe, etc., for garage and blacksmith shop.

Que., Shawville—Connelly & Eades, J. W. Eades, Purch. Agt.—garage and repair shop equipment, including tools, emery wheel and stand.

Machinery Wanted

Ala., Mobile—K. N. Heath, 116 Hendon Ave.—woodworking machine.

D. C., Wash.—Bureau of Supply, Treasury Dept.—one combination forged drill, anvil and vise.

Ill., Chicago—Blue Valley Creamery Co., 700 South Clinton St.—machinery for proposed $40,000 plant at Bemidji, Minn.

Ill., Freeport—J. Knobel & Son, 4 Exchange St. (produce)—refrigeration machinery, several ton capacity, motor or belt drive.

Ind., Indianapolis—T. L. Green & Co., 202 Miley Ave.—one 5 to 7 ton traveling crane.

Ind., New Albany — New Albany Loose Leaf Tobacco Co., Locust and Clark Sts.—hydraulic presses for new tobacco warehouse.

Ind., South Bend—W. Reeser, 1345 North Welker St. (woodwork)—16 to 20 in. pony planer.

Kan., El Dorado—B. A. Runyan—job printing press and stereotype outfit.

Kan., Lawrence—Jarpy Machine Wks., 110 West 8th St., J. Jarpy, Purch. Agt.—10 in. bench miller (used).

Ky., Louisville—Office of United States Engineer, P. O. Box 72—one cutting torch, 20 to 24 in. long, with 90 deg. head for use with hydrogen; ten injectors, ¾, 1 and 1¼ in.; eight lubricators, double connection, brass forced feed; six hundred bars, round, soft steel, ⅞ to 1¼ in.; eleven sheets, ½ and ¾ x 48 x 108 in. structural plate; six 6 in. sheaves for ⅝ in. wire line.

Ky., Sutton—Sutton Coal Co.—coal handling machinery, etc.

La., New Orleans—Loubet Glassware & Cork Co., Ltd., 510 Bienville St.—complete equipment and special machinery for the manufacture of glassware, to replace that which was destroyed by fire.

Md., Baltimore — Sterling Drug Corp., Chandler Bldg.—machinery and equipment for new chemical plant.

Md. Elkton—Colonial Tool & Forge Co. (manufacturer of screwdrivers and tools), L. V. Blue, Pres.—machinery and equipment, including power hammers, shafting, hangers, etc., for new plant.

Mass., Barnstable—School Com.—equipment, including saws, tables, benches, lathe, planer, drills and miscellaneous small tools, for manual training department of new high school.

Mass., Boston—Amer. Box Co., 56 West Canton St., address manager—woodworking tools, including belt or disc sander, double spindle borer, power screw driver, medium size cutoff saw, etc. (used).

Mass., Boston—The city, Public Bldg. Dept. —manual training machinery and equipment for proposed $3,000,000 high school.

Mass., Brighton (Boston P. O.)—Hatfield Stair Bldg. Co., 124 Western Ave., address the manager—woodworking machinery, including lathe, saws, planer, drill, belting, pulleys, etc., to replace that which was recently destroyed by fire.

Mass., Milford—W. J. Collins Fdry. Co., 22 Franklin St., address manager—equipment for proposed addition to foundry.

Mass., Westfield—H. B. Smith Co.—equipment, including furnaces, melting pots, etc., for addition to foundry.

Mich., Detroit—W. Campbell Co., 5660 Merritt Ave. (manufacturer of fireless cookers)—one electric butt welder, small capacity.

Mich., Detroit—Detroit Concrete Receptacle Co., 4225 Michigan Ave.—equipment for handling concrete and sheet metal for proposed $250,000 factory for the manufacture of concrete ash receivers and garbage receptacles.

Mich., Mayville—Hardwood Products Co. —one 48 in. and one 54 in. veneer clipper.

Minn., Duluth—Cutler-Magner Co., foot of 8th Ave., W. (cement, lime and salt dealers)—machinery and equipment for $300,000 warehouse, to replace that which was destroyed by fire.

Miss., Hattiesburg—Tatum Lumber Co.—sawmill machinery.

Mo., Joplin—Race Track Mining Co., c/o B. E. Brown, W. Goodwin, Purch. Agt.—belting, hangers, shafting, pulleys and bearings.

Mo., Kansas City—Dean Rubber Co., 561 Grand Ave.—machinery for the manufacture of rubber water bottles.

Mo., Kansas City—H. H. Hervy, 209 Oak St. (machinery dealer)—five bar bending machines.

Mont., Hinsdale—J. E. Greene—one linotype and one intertype machine, belting, hangers, pulleys and newspaper press (used).

N. Y., Albion—Albion Furniture Mfg. Co., Inc., W. D. Wright, Purch. Agt.—woodworking machinery and equipment to enlarge plant.

N. Y., Au Sable Forks—Marr & Gordon —stone cutting machinery and equipment for marble cutting and quarry.

N. Y., Buffalo—K. Bauerle, 50 Cambridge St.—equipment for bakery at 93 Cherry St.

N. Y., Buffalo—Bemis Bros. Bag Co., 829 Chamber of Commerce—equipment for the manufacture of cotton burlap and paper bags for plant at 711 Northland Ave.

N. Y., Buffalo—Berling Magneto Co., Inc., 42 Laird Ave.—equipment for light assembly work on magnetos.

N. Y., Buffalo—Boehm Bros., 101 Norfolk St.—tools, saws, planers and equipment for new carpenter shop.

N. Y., Buffalo—Elba Cold Storage Co., Inc., C. Eismann, c/o Buffalo Vegetable Marketing Co., 29 East Market St., Genl. Mgr.—refrigeration equipment, hangers, pulleys, etc., for cold storage plant at Elba.

N. Y., Buffalo—R. W. Miller, Sycamore St. and Sweet Ave.—equipment for bakery.

N. Y., Buffalo—J. Willson, 256 Esser Ave. —upright Bradley hammer.

N. Y., Lyons Falls—Waters Mfg. Co., S. W. Sylvester, Purch. Agt.—machinery and equipment for plant for the manufacture of automobile parts and accessories.

N. Y., Marlboro—Record—cylinder or flat bed newspaper press.

N. Y., New York—Amer. Spectacle Co., 136 West 52nd St.—power cutting machine.

N. Y., New York—F. Hawley, 244 West 42nd St.—bandsaw.

N. Y., New York—L. Robertson, Inc., 540 West 22nd St. (machinist)—air compressor.

N. Y., North Tonawanda—Northern Lumber Co.—machinery and equipment for lumber mill.

N. Y., Rochester—Rochester Refrigerating Co., 1980 East Ave., R. Tomlinson, Pres.—refrigeration machinery and equipment for proposed addition, to contain 100,000 sq.ft. of floor space.

N. Y., Rochester—Stuart-Oliver Metal Finishing Co., 222 North Water St. (automobile body finisher), O. D. Stuart, Pres.—machinery and equipment for enameling and plating metal.

N. Y., Sherburne—Bd. Educ.—manual training equipment for proposed $175,000 high school.

N. Y., Utica—Powell Muffler & Timer Co., 316 Catherine St. (manufacturer of automobile mufflers)—machinery, hangers, pulleys, etc., for addition to plant.

N. C., Burlington—Community Refrigerating Co.—20 ton raw water ice plant, electrically driven, at Jacksonville, Fla.

N. C., Lakeview—J. B. McQueen, Vice-Pres.—equipment for proposed $300,000 cotton mill at Hemp.

N. C., Wilmington—Atlantic Coast Line R.R., A. C. L. Bldg., F. H. Fechtig, Purch. Agt.—woodworking machinery for the manufacture of passenger coaches.

N. C., Wilmington—W. Clark, P. O. Box 824—2 ton hoist and a steam driven gravel loader.

N. D., Arnegard — McKenzie County Farmer—model 15 linotype machine.

O., Canton — Wilson Rubber Co., 1216 Garfield Ave., F. J. Wilson, Vice Pres.—machinery for the manufacture of rubber gloves, molds and specialties.

O., Cleveland—Cleveland Wheelbarrow & Mfg. Co., 4001 West 25th St.—wiring press, No. 4 W. Bliss or equal, 24 in. stroke, 50 in. between gibs.

O., Columbus—Columbus Varnish Co., 262 Cozzens St., S. W. Hanna, Genl. Mgr.—complete equipment, including three mills, mixers, etc., for large addition to plant.

O., Columbus—E. J. and W. E. Jones, 406 West Spring St.—one molding machine and other woodworking equipment.

O., Lancaster—Natl. Glass & Lens Co., A. Steiner, Purch. Agt.—special machinery and equipment for the manufacture of patent lens.

O., Marion—J. M. Ruffner—20 ton Fairbanks wagon scales.

O., Mount Vernon—MacGee-Starr Granite Co.—machinery, equipment, conveyors, hoisting machinery, etc., for proposed building stone plant.

O., Piqua—Orr Felt & Blanket Co.—complete special machinery and equipment for the manufacture of blankets and felt coverings.

O., Toledo—Bingham Stamping Co., Post and Albion Sts. (manufacturer of stamping for automobiles, etc.)—special machinery, forging, furnaces and equipment for proposed addition to plant.

O., Toledo—Ranson & Randolph, Superior St.—special equipment and chemical machinery, etc., for proposed plant for the manufacture of dental supplies.

O., Uhrichsville—Federal Collieries Co. (manufacturer of sewer pipe)—complete machinery and equipment for proposed $3,000,000 plant.

Ore., Eugene—Eugene Daily Guard, J. E. Shelton, Purch. Agt.—16 page stereotyping press.

Pa., Erie—Sims Mfg. Co., Whitley Ave. (manufacturer of castings, etc.)—foundry equipment.

Pa., Meshoppen—C. B. Tyler—complete machinery and equipment for proposed $40,000 flour mill.

Pa., New Brighton — Damascus Steel Casting Co.—foundry equipment.

Pa., Pittsburgh—Amer. Reduction Co., 2208 Forbes St. (garbage and refuse reduction)—one belt conveyor.

Pa., Pittsburgh—R. R. Lambert Co., Charles and Crispen Sts. (lumber yard, mill and brick yard)—hoisting machinery and equipment, to replace that which was destroyed by fire .

Pa., Pittsburgh—Natl. Nut & Bolt Co., 62nd St. along tracks of Allegheny Valley St. Ry.—bolt head trimmers, capacity ½ in. diameter and larger.

Pa., Pittston—World Playing Co., Oregon Heights — complete machinery and equipment for plant for the manufacture of playing cards.

Pa., Sheffield — Endstrom-Wetmore-Henderson Co.—complete machinery and equipment for proposed $50,000 plant for the manufacture of window shade rollers.

Tex., Dallas—J. C. Melton, 619 Martinique Ave.—job printing press and paper cutter.

Tex., Houston—Houston Ry. Car Co., P. O. Box 223, M. R. Darcey, Purch. Agt.—galvanizing machinery and equipment for the manufacture of refrigerating tanks.

Tex., Sulphur Springs—Hopkins County Echo—duplex 8 page press.

Va., Graham—Bluestone Furniture Co.—lathes for turning wood.

Va., Lynchburg — Craddock-Terry Co. (manufacturer of shoes)—special machinery and equipment for proposed $150,000 addition to plant.

Va., Lynchburg—N. B. Handy Co., 9th St.—bar benders.

W. Va., Fairmont—Fairmont Cleaners & Dyers Co., Boulevard Ave.—dyeing machinery and equipment for new plant.

W. Va., Fairmont—F. W. McIntyre, Morgantown Ave.—bench tools and equipment for garage.

W. Va., Fairmont—Willets Clay Pottery Co.—machinery and equipment for $200,000 plant, to replace that which was destroyed by fire.

W. Va., Harrisville—Standard—7 column quarto newspaper press.

W. Va., Keystone—French Sand Dryer Co., C. S. French, Mgr.—dressing machines, lathes, etc., for the manufacture of sand dryers.

W. Va., Petersburg—R. B. Bird—broom making machinery.

Wis., Cambridge—J. Porter—large air compressor.

Wis., Green Bay — G. Richardson, 133 North Pearl St.—shaper, mortiser, sticker and sander.

Wis., Madison—J. E. Boettcher Co., 518 Wingra St.—special machinery and equipment for the manufacture of measures, weighing devices, etc., for plant at Waunakee.

Wis., Madison—A. Fiore Co., 620 West Mifflin St.—gasoline storage tanks and pumps for proposed filling station on Commonwealth and Monroe Sts.

Wis., Marshfield — Berg Supply Co., T. Berg, Mgr.—machinery and small tools for plant for the manufacture of barn equipment at Brillon.

Wis., Milwaukee—Dittmar Printery, 1180 11th St.—paper cutting machine.

Wis., Milwaukee—J. A. Hentz, 700 11th St.—laundry machinery, including power washer, mangle, ironer, dryers, belting and shafting.

Wis., Milwaukee—Logemann Bros., 3130 Burleigh St. (manufacturer of baling presses)—traveling crane.

Wis., Milwaukee — United Consumers Corp., 4519 Lisbon Ave.—air compressor with service station.

Wis., Newhope (Amherst Junction P. O.) —J. M. Rustad—bandsaw, circle saw and jig saw for sawmill.

Wis., North Milwaukee — A. Krueger, Route 5, Box 142—combination woodworker to include five operations.

Wis., Oconomowoc—P. Binzel—vegetable canning machinery, including viners, sealers, conveyors, belting and shafting.

Wis., Rice Lake—Chronotype—2 revolution newspaper press to take 24 x 36 in. sheets.

Wis., Sun Prairie—Standard & Specialty Porcelain Co., L. A. Stohl, Mgr.—dry kiln equipment and clay drying machinery.

B. C., Sapperton—Swift Canadian Packing Co., Ltd. (meat, lard, etc.)—complete equipment for refinery.

Ont., Atikokan—E. T. Moore—special machinery for the manufacture of boring piston rod packings.

Ont., Cobden—W. Gibson—special machinery for the manufacture of a carrier control system.

Ont., Hamilton—Canadian Westinghouse Co., Ltd., Aberdeen St.—furnace, cranes and moulds for proposed $250,000 foundry.

Ont., Kitchener—Schneider Packing Co.—equipment for factory.

Ont., North Wakefield—A. Latourelle—gasoline pump and garage tools.

Ont., Ottawa—Compagnie de Poinconneuse Automatique de Fiches Limitee, c/o G. E. Robert, 301 King Edward Ave.—equipment for the manufacture of self feeding gang punching machines.

Ont., Pembroke—J. M. Cameron, 361 Pembroke Rd.—vulcanizing equipment.

Ont., Pembroke—C. Devlin & Son, 274 Pembroke Rd.—foundry equipment.

Ont., Port Hope—Bush English China Co., Ltd.—complete equipment for the manufacture of china.

Ont., Toronto—Dacks, Ltd., 73 West King St., S. E. Dack, Purch. Agt.—rebuilt Peerless perforator.

Ont., West Lake—West Lake Brick Co.—equipment for proposed $30,000 brick plant capacity 40,000 brick per day, at Wellington.

Ont., Windsor—Ontario Power Comn., A. Beck, Pres.—machinery and equipment for proposed plant for the manufacture of gas and byproducts.

Que., Ladysmith—R. C. Holt—blacksmith shop equipment.

Que., Levis—L. N. Huard, 129 Commerciale St.—complete equipment for pulp mill on the Megiscane River near Temiskaming.

Que., Montreal—All Clear Windshields, Ltd., W. C. Nicholson, 15 Vendome Ave., Purch. Agt.—complete equipment for the manufacture of automobile accessories.

Que., Montreal—Canada Steamship Co., Victoria Sq.—coal handling machiery for Fort William, Ont.

Que., Montreal—J. A. L. Leclair, 654 Fabre St.—gasoline tank, air compressor and pump.

Que., Montreal—C. Picard, 943 Gouin Blvd., W.—gasoline tank, pump and air compressor.

Que., Pointe au Pere—W. Raymond—portable drill, air compressor, etc., for automobile repairs.

Que., Quebec—E. Andrews, 281 Arago St.—bench tools and chain hoist for garage.

Que., Quebec—St. Regis Pulp & Paper Co., Ltd., 70 St. Paul St.—complete equipment for pulp mill at Cap Rouge.

Que., Shawville—J. Brounlee—forge, bench tools and other equipment for blacksmith shop.

Que., Shawville—J. Rennick—forge and other equipment for blacksmith shop.

Metal Working Shops

Calif., Bakersfield—The Kern County High School Dist. awarded the contract for the construction of shop buildings. Estimated cost $85,839. Noted Sept. 27.

Calif., San Francisco—The Victor Oxyacetylene Equipment Co., 884 Folsom St., is having plans prepared for the construction of a 2 story shop on Folsom St. near 4th St. Cost will exceed $15,000. R. W. Jenkins, 918 Harrison St., San Francisco, Archt.

Calif., San Jose—The Pacific Gas & Electric Co., 445 Sutter St., San Francisco, is having plans prepared for the construction of a warehouse and garage, here. Cost will exceed $90,000. Private plans. Noted Feb. 8.

Calif., Visalia—J. B. Newman, G. & I. Bldg., is having plans prepared for the construction of a 1 story, 100 x 215 ft. garage on East 9th St. Private plans.

Ill., Aurora—The Barber-Greene Co., West Park Ave., manufacturer of conveyors, plans to build a 1 story, 130 x 175 ft. and a 24 x 45 ft. addition to plant. Estimated cost $40,000.

Ill., Chicago—The Hartman Furniture & Carpet Co., Pershing and Wentworth Sts., awarded the contract for the construction of a 1 story, 124 x 167 ft. garage at 3927-43 Wentworth St. Estimated cost $75,000.

Ill., Chicago—E. A. Heckel, c/o J. Hocke, Archt., 7602 Chappel Ave., is having plans prepared for the construction of a 1 story, 150 x 191 ft. garage on Exchange St. between 72nd and 73rd St. Estimated cost $65,000.

Ill., Chicago—J. Ure, c/o Van Gunten & Van Gunten, Archts., 26 East Huron St., awarded the contract for the construction of a 1 story, 75 x 105 ft. automobile sales and service station at 7517 North Clark St. Estimated cost $40,000.

Ill., Maywood—Van Gunten & Van Gunten, Archts., 26 East Huron St., Chicago, are receiving bids for the construction of a 1 story, 125 x 125 ft. pattern and machine shop, here, for J. A. Kennedy, c/o Architects. Estimated cost $40,000.

Ill., Waukegan—P. Gerhardt, Archt., 64 West Randolph St., Chicago, is receiving bids for the construction of a 1 story, 80 x 230 ft. automobile sales and service station on Madison and Spring Sts. for C. E. Bairstow, 111 South Sheridan Rd., here. Estimated cost $40,000.

Ind., Evansville—The Graham Bros. Truck Co. plans to build 1 story, 90 x 250 ft. Unit 6 of truck factory. Estimated cost $60,000.

Ind., Richmond—The Terre Haute, Indianapolis & Eastern Traction Co., Traction Terminal, Indianapolis, plans to build a car barn and repair shop, here. Estimated cost $50,000.

Ky., Louisville—The Standard Sanitary Mfg. Co., 6th and A Sts., is having plans prepared for the construction of a 1 story addition to pattern shop on 6th and Shipp Sts. Estimated cost $40,000. D. X. Murphy & Bro., Louisville Trust Bldg., Louisville, Archts.

Mass., Boston—The Grovehall Realty Trust Co., c/o E. P. Finn, 1 Beacon St., will build a 1 story, 175 x 250 ft. garage at 1186 Commonwealth Ave. Estimated cost $250,000.

Mass., Milford—The W. J. Collins Fdry. Co., 22 Franklin St., plans to build a 1 story, 50 x 75 ft. addition to foundry. Estimated cost $25,000.

Mich., Detroit—The Kroger Grocery & Baking Co., 4760 Merritt Ave., is having plans prepared for the construction of a 1 story, 85 x 365 ft. garage on Junction Ave. Estimated cost $90,000. J. G. Kastler & Co., 523 Detroit Savings Bank Bldg., Archts. Noted Mar. 8.

N. Y., New York—J. Lagana, c/o J. J. Dunnigan, Engr. and Archt., 394 East 150th St., is having plans prepared for the construction of a 1 story, 55 x 130 ft. garage on Convent Ave. Estimated cost $50,000.

N. Y., New York—The Northern Union Gas Co., Webster Ave., is having plans prepared for the construction of a 4 story shop and office building on East Kingsbridge Rd. Jardine, Hill & Murdock, 347 Madison Ave., Engrs. and Archts.

O., Cleveland—F. B. Sanders, c/o Craig-Curtiss Co., Contrs., 4614 Prospect Ave., awarded the contract for the construction of a 2 story, 50 x 100 ft. garage at 3422 Prospect Ave. Estimated cost $40,000.

O., Toledo—The Bingham Stamping Co., Post and Albion Sts. (manufacturer of stamping for automobiles, etc.), is having plans prepared for the construction of an addition to plant. Hohly & Gram, Archts.

Pa., Phila.—L. Friedman, Inc., Agent, 251 South 15th St., will soon award the contract for the construction of a 1 story, 26 x 53 x 76 x 102 x 125 x 211 ft. garage on Carlisle St. near Montgomery Ave. Estimated cost $175,000. L. Rothschild, 215 South Broad St., Archt.

Pa., Sharon—The J. Moyer Motor Car Co., North Main St., awarded the contract for the construction of a garage. Estimated cost $20,000.

R. I., Providence—The Textile Finishing Mchy. Co., 171 Westminster St., awarded the contract for the construction of a 1 story, 76 x 121 ft. roll shop and a 2 story, 61 x 110 ft. storage building. Estimated cost $80,000. Noted Sept. 13.

Tex., Austin—The State of Texas Institute for Colored awarded the contract for the construction of a 2 story industrial building and warehouse. Estimated cost $51,882.

Tex., Valentine—The Southern Pacific R.R., Southern Pacific Bldg., Houston, is having plans prepared for the construction of railroad shops, here. Cost will exceed $100,000. G. W. Beschke, 65 Market St., San Francisco, Calif., Ch. Engr.

Va., Richmond—The W. T. Rawleigh Co., 101 Liberty Ave., Freeport, Ill., is receiving bids for the construction of a 2 story, 80 x 165 ft. warehouse and garage, here. W. J. Trevillian, Vice Pres. J. R. and E. J. Law, 1st Central Bldg., Madison Wis., Archts.

W. Va., Huntington—J. J. Weiler & Sons, Robson-Prichard Bldg., plan to build a 1 story, 30 x 210 ft. structural steel shop. Estimated cost $50,000.

Wis., Biron (Grand Rapids P. O.)—The Consolidated Water Power Paper Co. plans to build a machine shop. Estimated cost $40,000.

Wis., Delavan—A. H. Schumacher will soon award the contract for the construction of a 2 story, 40 x 66 ft. and 20 x 32 ft. garage. Estimated cost $50,000. H. C. Hengels, 445 Milwaukee St., Milwaukee, Archt. Noted Oct. 4.

Wis., Elkhorn—G. A. Van Velzer, Williams Bay, awarded the contract for the construction of a 1 story, 52 x 100 ft. garage, here. Estimated cost $40,000. Noted Oct. 18.

Wis., Hurley—N. A. Nelson, Archt., Ironwood, Mich., is receiving bids for the construction of a 1 story, 98 x 100 ft. garage for Noeman Bros., here. Estimated cost $50,000.

Wis., Kenosha—The Amer. Brass Co., 570 Elizabeth St., is receiving bids for the construction of a 1 story, 222 x 542 ft. wire mill. Private plans.

Wis., Kenosha—The city, C. M. Osborn, Mgr., is having plans prepared for the construction of a 1 story garage. Estimated cost $40,000. J. M. Albers, City Hall, Archt.

Wis., Madison—The D. Belsic Co., 213 East Washington Ave., awarded the contract for the construction of a 2 story, 66 x 120 ft. garage and repair shop. Estimated cost $40,000.

Wis., Madison—The Chicago & Northwestern Ry., c/o B. R. Kulp, Engr., 201 South Blair St., awarded the contract for the construction of a 2 story, 50 x 100 ft. machine and repair shop. Estimated cost $40,000. Noted Sept. 6.

Wis., Madison—The Madison Nash Co., 155 East Wilson St., will build a 2 story, 66 x 122 ft. garage and repair shop. Estimated cost $60,000. A. R. Dillon, Mgr.

Wis., Madison—F. Riley, Archt., Conklin Bldg., is receiving bids for the construction of a 2 story, 45 x 100 ft. garage, boiler house and laundry for the Madison Medical Assn., c/o R. S. Ingersoll, Lakeside St. Estimated cost $50,000. Noted Oct. 11.

Wis., Milwaukee—The Finkler Motor Car Co., 924 3rd St., awarded the contract for the construction of a 1 story, 62 x 100 ft. addition to garage. Estimated cost $40,000.

Wis., Plymouth—J. E. Curtiss is having plans prepared for the construction of a 2 story, 60 x 90 ft. garage and repair shop. Estimated cost $40,000. E. A. Juul, Security Bldg., Sheboygan, Archt. Noted Oct. 4.

B. C., Victoria—The Dominion Government, Ottawa, Ont., awarded the contract for buildings, including a machine shop, etc., at the Esquimalt Dock, here. Estimated cost $350,000.

Ont., Hamilton—The Canadian Westinghouse Co., Ltd., Aberdeen St., awarded the contract for the construction of a 1 story foundry. Estimated cost $250,000. Noted Sept. 13.

Read the

SEARCHLIGHT SECTION

the "Opportunity" Advertising of the Machinery Field

See pages 173 to 186